UNITED STATES ARMY

OCTOBER 1975

AVIATION DIGEST

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The Metric System ..... Inside Back Cover

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A major activity of the
U. S. Army Training and Doctrine Command

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ABOUT THE COVER

The British Army's Gazelle flies over the countryside in England and sets this month's theme: "antiarmor tactics." The British view begins on page 4; the French on page 6; and the American on page 2

The mission of the *U.S. ARMY AVIATION DIGEST* is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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2.75 Inch Symposium Summary

Mr. Robert Vayda, DAC
2.75 Inch Rocket Project Manager's Office,
Army Missile Command, Redstone Arsenal,
Huntsville, AL

Also see "Symposiums," page 24

A NAVY commander's cap hung alongside those of his Army and Air Force associates at the 18th Tri-Service Meeting on the 2.75 Inch Rocket System held last August at the U.S. Army Aviation Center at Fort Rucker. It signified his team role in a conference of 80 key representatives from the Army, Navy, Air Force, Marines and Department of Defense. Each was concerned with this unique weapon and heard reports about the latest developments in the use of the 2.75 Inch Rocket, once dubbed the "Mighty Mouse."

The welcome and opening remarks were presented by the commander of the center, Major General William J. Maddox Jr.

The thrust of presentations on 2.75 Inch Rocket System improvements was oriented toward upgrading the largely antipersonnel capability of the Vietnam era, to a system which has effective application in the 1980 timeframe against a broader spectrum of targets employing low level tactics at increased standoff ranges.

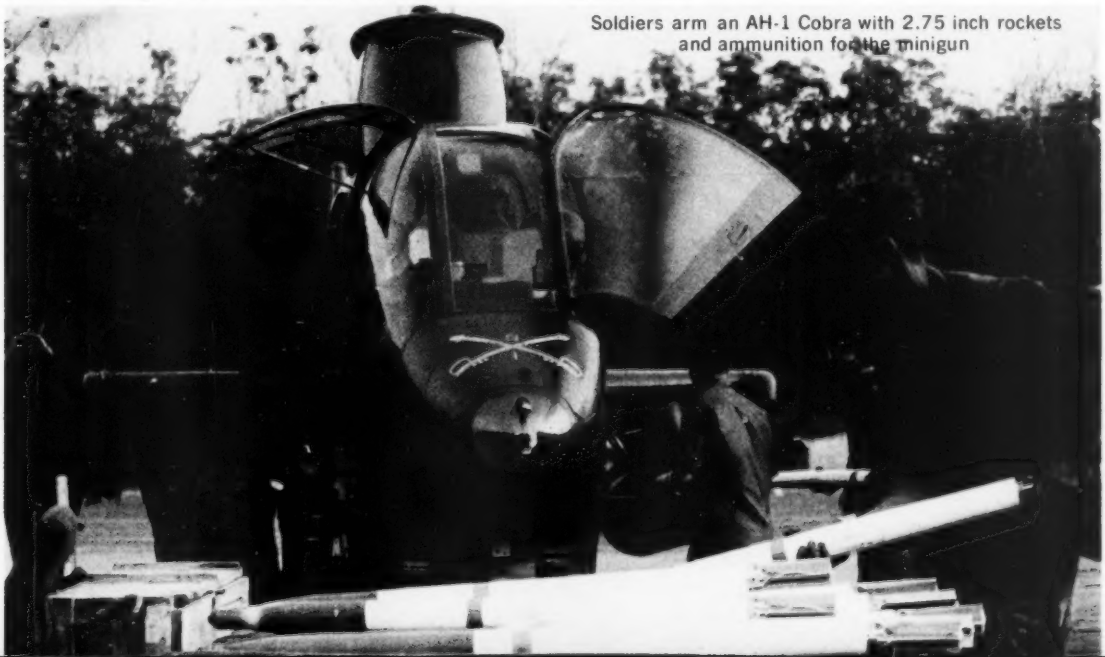
Specifically, the system is oriented to an aircraft armament subsystem with a variety of warheads which can provide flexibility, spanning from high lethality target destruction to neutralization of defined area targets, consisting of personnel and materiel. To meet this demand, the overall objective is oriented toward meeting the requirements of the user for an improved aerial rocket subsystem.

In summation, it was generally concluded that for future military operations, the 2.75 Inch Rocket System will play an important role as an aerial weapon system capable of delivering effective fires upon the enemy regardless of the level of conflict.

Attendees at the conference represented senior management and technical expertise from a spectrum of Department of Defense agencies. Army representatives included participants from the Department of the Army; Training and Doctrine Command; and other Army supporting subcommands and agencies. The Navy was represented by the Naval Air Systems Command; Naval Surface Weapon Center; mission support activities—plus the Marine Corps. Air Force attendees represented the Air Force Systems Command; the Air Force Logistics Command; and key support centers. The Department of Defense was represented by the Air Munitions Requirements and Development Committee.

The Tri-Service conference chairman was Army Colonel James L. Tow, Project Manager from the project office at the U.S. Army Missile Command, Redstone Arsenal, AL. Lieutenant Colonel Robert L. Graham, also from the Missile Command, was the moderator.

In future issues the *DIGEST* will furnish readers with additional coverage of topics discussed in this symposium.



Soldiers arm an AH-1 Cobra with 2.75 inch rockets and ammunition for the minigun

That First Battle

Major General William J. Maddox Jr.

Commander, U.S. Army Aviation Center

. . . we now have an antitank helicopter capable of doing the heaviest of battlefield tasks: that is, routinely killing enemy armor. The AH-1 Cobra TOW does this and is being deployed as these words are written . . .

SURE, WE WILL win that first battle of the next war!

And that isn't just sloganeering either. While it is often said that generals tend to fight the next war like they fought the last war, this can't be the case the next time the U. S. Army goes into combat. Instead, we must know very well what the next battlefield will look like before we get there. We must think through that first battle and we must prepare carefully to go onto that battlefield.

In no first battle of the past have we had the philosophy of winning prescribed in advance. Rather, we have entered the first battle with the feeling that we must hang on until we build our forces and equipment to the point where they will carry the day. This usually takes a period of a year or more.

What will that first battlefield look like? In some respects it will be the same as all the other battlefields. It will be the same ugly, dirty place where people get killed—where Soldiers are tense and where mistakes are made. We may well see many of the same weapons in enemy hands that we saw in the last battle of the last war. We may well be using the same equipment and aircraft that we used before. Even some of the men who fought the last battle may be on the next first battlefield.

Our leaders can expect the traditional American courage, inspiration, ingenuity and luck from our people whether they were combat tested previously or have never been to combat before. These factors will be just as they always have been on the battlefield.

Yet, the first battle of the next war will be different. There is no question that the potential enemy may well be equipped with a host of new weapons and equipment. The enemy probably will be more sophisticated than pure infantry formations. This means that he will have more equipment and more technology working for him. It also means that he probably will be more visible on the battle-

field, but he also will be better protected.

We can expect to see enemy in tanks and armored personnel carriers supported by armored artillery and perhaps even by weapon-carrying helicopters. Such sophisticated forces understand the importance of antiaircraft protection. Therefore, they can be expected to run antiaircraft weapons as an integral part of frontline formations.

On the aircraft-antiaircraft side of the house, the standard gun systems will be beefed up with radar direction and seeker type warheads. On the worst case battlefield that military planners must prepare for, a sophisticated array of antiaircraft weapons will be available to sweep the skies of most aircraft. If the 1973 Mideast experience is any indicator, there probably will be a great proliferation in the whole family of weapons that can be brought to bear on our aircraft. The weapons will have greater lethality and greater effective hitting range than in past battles.

If major forces are involved, the battlefield probably will be linear rather than the 360-degree battlefield that we knew in the past. In the 360-degree battlefield, we normally went up to get out of range of hostile aircraft weapons. But on the new linear battlefield we will depend on getting low and hiding ourselves in the terrain. No matter how large the forces, there will be fluidity and open flanks to be covered or to be assailed. There will be opportunities and openings to be exploited. There will also be heavy combat where mastery of the tactics of fire and maneuvers will be essential.

For our part, much of our battle expereince so carefully paid for in years of combat will have dwindled through retirement, discharge and promotion. Many of our contemporaries on the next first battlefield will be neophytes to battle. For those who saw combat before, the memories may be dimmed at least at the time of the opening shock. Once the old timers get the feel of the battlefield again, the old wilyness will come back. But, we can expect the first few minutes to be much different the next time.

As always, the first battle will probably come at a time and place of the enemy's choosing. Remember that the enemy always has initiated the first battle and he has been prepared psychologically for it. Historically as we have fought, in a defensive posture, we have faced an enemy who is in peak condition for the fight with all of his logistics and equipment tuned for the task ahead. He was acclimatized, and he was in no peacetime frame of mind.

Another important point: the job will be different. We probably will have a pretty heavy organization if we are to fight enemy tanks and their accompanying antiaircraft weapons. While we will fight outnumbered for a certainty, we must figure a means of making the equipment we do have more effective.

If the first battle were to come at once, some of our equipment would be better than what we closed the last war with. For instance, we now have an antitank helicopter capable of doing the heaviest of battlefield tasks: that is, routinely killing enemy armor. The AH-1 Cobra TOW (tube-launched, optically-tracked, wire-guided) does this and is being deployed as these words are written. In fact, the antitank helicopter is one tool which will permit us to stretch the capabilities of our outnumbered forces on that next battlefield. By virtue of its mobility to stand off against antiaircraft arrays and kill with surgical precision, the Cobra TOW is adding a new dimension to warfare.

The Cobra of the next battlefield will be a heartier performer than it was on the last battlefield. It not only will have a point-target kill capability, it will be hardened for survivability and improved in performance and agility. It will be nearly invisible to the heat-seeking weapons we saw in the last battle and its terrain flight tactics will give it substantial protection from optical and radar tracking weapons.

However, one of the biggest differences on the next battlefield is the requirement that our people be highly trained right from the moment the first round whizzes by. It has been said wisely that what can be seen can be hit, and what can be hit can be killed. In such an environment our flight crews can't afford the first mistake. And as an Army, we will find the first battle will be so crucial that we cannot afford to lose because there may be no second battle. This translates into the conclusion that we must be *completely* prepared for the first battle.

While we may have the best equipment on the battlefield that goes for naught if our people are not prepared to use it. Their bravery and willingness to die if need be can't compensate either. They can't win the first battle unless they offset the numerical advantage of the enemy through superior employment. So, if we are sincere in winning that first battle, we had better be completely ready for it when it happens. Preparation means training—it means proper tactics, and it means proper outlook.

Sure, we will win the first battle of the next war. Having examined what the next battlefield may be like, the similarities, the differences, we understand that the next battlefield could be very much like the last. But, it is not likely to be. History argues against that. So now is the time to prepare if we really want to be sure about winning.

This article is based on the latest pamphlet of instruction issued to the British Army by Headquarters, Director Army Air Corps, the author's personal experience in Europe and his observation of recent fire team training at the British Army Training Unit at Suffield in Canada. The intention is not to produce a complete guide to British antitank helicopter tactics but

BEFORE ENGAGING IN any discussion of British helicopter antitank tactics, it is necessary to point out that all our aircraft are established in fairly limited numbers and it follows therefore that the antitank helicopters will only be employed when a serious tank threat cannot be dealt with satisfactorily by other systems. This means, in effect, that they will be normally used where:

- Other antitank weapons cannot be moved rapidly enough to deal with the threat.
- The ground prevents the deployment of normal antitank weapons.
- Conventional defensive systems are likely to be overwhelmed by the attackers.
- The longer range of the helicopter-carried missile is required.

It readily can be seen from the foregoing that the antitank helicopter is regarded in the British Army mainly as a counter penetration system. It is considered a most valuable asset and not one to be frittered away on offensive operations to the possible detriment of the defensive battle.

In the defensive battle the fire team tactics would be based on the following factors:

- Preplanned areas of engagement whenever possible.
- Continuous reconnaissance to establish the movement and latest position of the target.
- Concealed fire positions.
- Engagement at maximum range.
- The maintenance of pressure and the need to impose maximum delay.

The Fire Team

The aircraft presently used by the British Army in its antitank operations are:

Light Observation Helicopter. The Bell 47-G (OH-13) is still the main light helicopter in service. It is flown with an aircrew of two and cruises at approximately 70 knots. This aircraft is in the process of being replaced by the Anglo French Gazelle which will give much greater speed, load, endurance and agility.

Antitank Helicopter. Our basic utility helicopter, the Westland Scout, is used for the antitank task. In this role it carries four SS-11 wire-guided missiles, an aircrew of two and it cruises at 100 knots.

The policy is to fly all helicopters with an aircrew of two, only one of which is a qualified pilot. The other crewmember is an enlisted man and is known as an *aircrewman*. He will have passed the normal aircrew selection tests and flight physical examinations and have attended a most comprehensive course. During this course great emphasis is placed on low level navigation and armoured vehicle recognition for it is in these areas that he is mainly employed in the air.

These soldiers qualify either as *observers* or *air gunners*. The difference being that the air gunner attends a course on the SS-11 and controls the missile in combat. He is required to maintain his missile guidance skills in addition to those of an observer.

The basic fire team comes from the six aircraft antitank flight of the Army Air Corps Squadron operating in the area and nominally contains all six helicopters split into two sections of three. It is, of course, perfectly possible to add extra sections as required from other antitank flights but it is felt

and is used for the antitank task. In this role it is armed with four SS-11 wire-guided missiles

Antitank Fireteam Tactics

The British View

Lieutenant Colonel A. E. Woodford,
Royal Artillery
British Liaison Officer, Fort Rucker

rather to emphasize certain skills and techniques which are peculiar to antitank engagement and without which the helicopter teams would not be truly effective or likely to survive. As indicated by its title, the scope of this article will be confined entirely to the fire team level. It will contain no mention of the higher formation tasking system and drills associated with it.

that four sections are the maximum that a single fire team leader can control. Basic sections are each given a specific designation.

It should be noted here that the fire team does not contain any light observation helicopters though their surveillance task is an essential part of the operation as will become obvious later.

Command And Control

The fire team normally is commanded by the flight commander providing the bulk of the aircraft in the team. Should a reinforcing section contain a more senior or experienced officer he may possibly take command.

The actual position of the fire team leader within the team has caused much discussion. There are three possibilities:

The Air Gunner's Position. In this case he also is acting as the missile aimer in addition to commanding the team and fire section of which he forms a part. It is felt that this arrangement could produce an excessive workload.

From the Rear Seat of an Antitank Helicopter. This system certainly reduces the workload and ensures that he can devote his full attention to the tactical battle; however, it has the disadvantage of almost certainly requiring a reduction in missile load in order to achieve sufficient endurance.

From the Observers Seat of a Light Helicopter. On the face of it this seems best of all. However with our present light helicopter (Bell 47-G Sioux) it is not a practicable proposition owing to the great disparity in speed between it and the Westland Scout. The current introduction of the Gazelle may well make this solution possible provided the overall priority of light helicopter allocation makes the extra aircraft available.

The fire section commander will invariably be a pilot and unless he is undertaking the additional duties of fire team leader, will fly the aircraft in which he travels.

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Le 'HOT' is hot!

Paul Hughes

Foreign Science and Technology Center
Charlottesville, VA

FOR THE BENEFIT of the uninitiated, HOT is a French acronym for "Haut – Subsonique Optiquement Teleguide" (high-subsonic-optically-teleguided). It applies to an antitank guided missile (ATGM) system that is creating comments and controversy in both the United States and Europe. Claims and counterclaims continue to be made concerning its effectiveness and reliability.

Those praising the system generally are connected with its development; its detractors generally are those with an interest in the U.S. TOW (tube-launched, optically-tracked, wire-guided) system. Since the two systems are competitors on the world market, the rivalry probably affects the comments to some extent. This article does not pretend to judge nor compare the TOW and HOT systems; the writer has no desire to become involved in any way in a TOW/HOT controversy.

This article concerns itself primarily with the helicopter-mounted HOT system. Characteristics and performance data, technical specifications and other unclassified data used are mainly furnished by the developers of the system. Users of this information are cautioned to bear this in mind: *This system has not been checked out in the U.S.*

HOT has been developed jointly by Aerospatiale of France and Messerschmitt-Boelkow-Blohm (MBB) of West Germany in accordance with operational principles and technical specifications jointly drawn up by the German and French military and civilian technical services. Designed for installation on a wide variety of land vehicles and helicopters with either manual or semiautomatic guidance systems, HOT is being installed in several versions in France and West Germany and promoted for sale abroad.

HOT is a long range antitank weapon system; its 13,125-foot 4,000 meter) range allows the firing helicopter to engage tanks while remaining out of range of the main tank armament. HOT's aver-

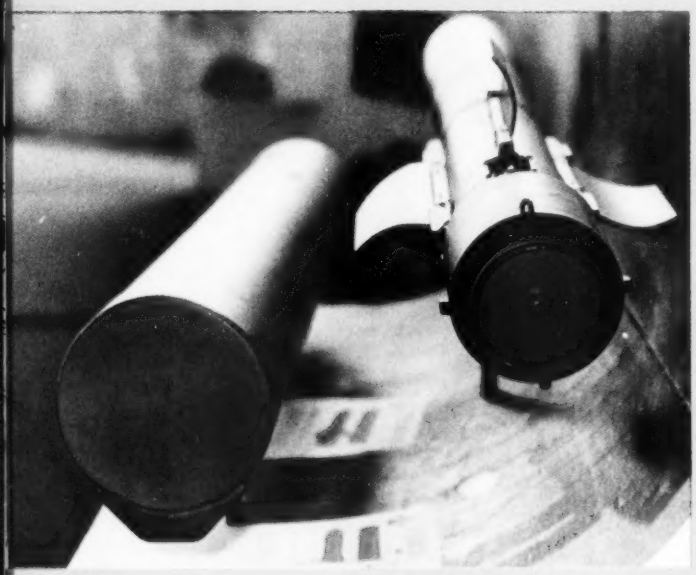


Figure 1
HOT antitank missile and transport/launcher tube

age velocity of 850 feet/second (ft/sec) (260 m/s) gives it a time-of-flight to maximum range of 16 seconds; minimum range when fired from the helicopter is 1,310 feet (400 meters).

French/German ATGM History: France was an early developer of the small antitank missiles, and its ATGM systems have been remarkably successful. Versions of France's ENTAC (early antitank missile system), SS-10, SS-11 and SS-12 have been purchased and employed by many countries, including the U.S. – which in itself is an endorsement for the French ATGM. Probably the most successful of these – certainly from the point of view of quantities produced and sold – was the SS-11.

Though a "first-generation" system, the SS-11 is still rather widely employed at home and abroad. It is a wire-guided system that reaches its 9,850-foot (3,000 meter) range in 23 seconds. It has been quite popular for helicopter installation. This is the system on which the HOT development is based. There have been criticisms that HOT relies too heavily on the SS-11 system and that HOT does not push the state-of-the-art enough.

West German technicians have been moderately successful in ATGM development. They produced an early ground-to-ground ATGM, the Cobra, that is still in production. Currently, France and West Germany are jointly involved in several missile programs for varied applications. Such systems as the Roland, Milan, Kormoran and Jumbo are partly or wholly West German developments. MBB has acquired considerable expertise in electronics, electrical systems and computers and it is these components of the HOT system that are MBB responsibility.

HOT Antitank Missile System: The system consists of the HOT missile, its transport/launcher tube, a gyroscopically stabilized sighting device and infrared (IR) detector, a command guidance unit, and a launcher suspension unit. HOT is a tube-launched, optical/infrared-tracked, wire-guided, second-generation missile which is based on the earlier, very successful, French

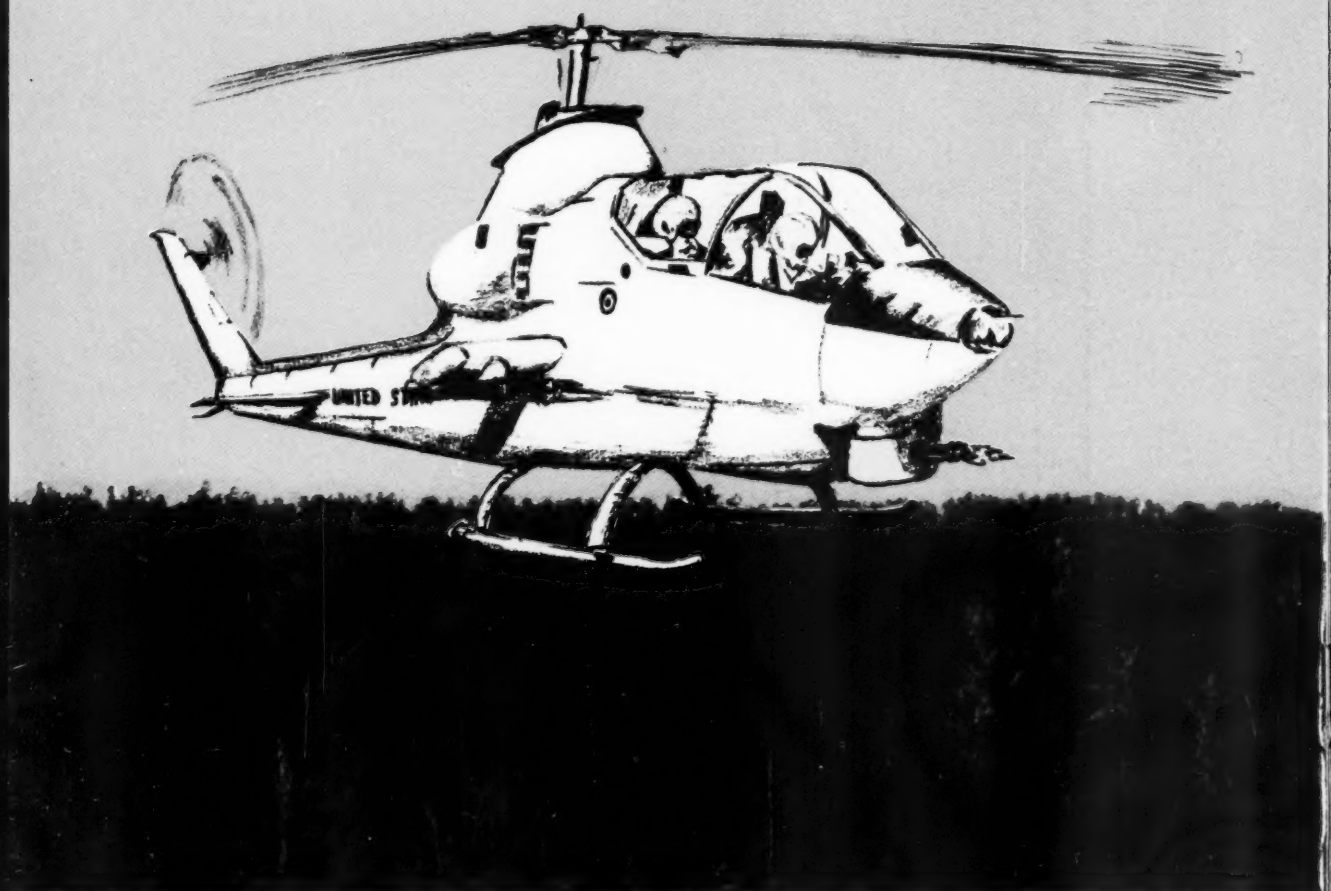
Continued on page 20

THE MARK OF THE PROFESSIONAL

LTC Martin R. Vissers

Chief Test Branch
Air Combat Directorate
HQ MASSTER
Fort Hood, TX

Sketch by Stanley Gryzwoc



PROFESSIONAL – having much experience and great skill in a specific role; as, a professional Army aviator." This definition (modified only in the last two words) is found in *Webster's New World Dictionary*. The purpose of this article is to explore for a few moments just which skills and what experience measure the professionalism of today's Army aviator.

Before the discussion, it is important to develop a little bit of common background. It is often painfully apparent to me that times have changed in the 18 years since I went to flight school. However, I want to assure you that across the board, times have definitely changed for the better. Perhaps the most significant change that I have observed over the years has been the change in attitude on the part of my contemporaries.

The Republic of Vietnam is the place where we won our spurs. Before that, "flyboys" were good for pushing throttles and pulling pitch, but in the eyes of their fellow Infantrymen, Artillerymen, et al, they weren't good for much else and were often regarded as overpaid chauffeurs and flying jeep drivers. We earned some of that attitude by being different from our fellow officers.

We were most easily identifiable from our ragged flight suits, flight jackets and different colored and shaped hats. We wore baseball caps of different hues long before the baseball cap itself was adopted by the Army. We have come a long way from those days and our track record on promotions and school selections verifies that we have assumed our rightful position among our contemporaries.

Let me talk about our aircraft for a moment. There are still a great many of us who can remember OH-13s without hydraulics; CH-21s that went into "jaw" instead of "friction"; U-6s and U-1s that could be depended upon to climb at 50 feet per minute when they were loaded and UH-19s that we wished were CH-34s. In the past 15 years the UH-1 Iroquois, better known as the Huey, has become to the OH-13 what the Cadillac is to the Model A. The U-21 is a Rolls Royce.

For the first time since I started in the business, the aircraft are carrying the aviators instead of the reverse being true. As late as 1963 and 1964 our experienced warrant officers in Vietnam were carrying those tired CH-21s around on their backs. How about the systems on the aircraft? I can remember filing an IMC (instrument meteorological conditions) flight plan into New York City with seven whole ultra-high frequencies to use when I got there.

Perhaps the area where we have made the greatest single stride is the weapons systems that are now integral parts of our aircraft: from KX-13-A1-1 (aerial 30 cal machineguns) strapped to the skids of OH-13s, we have progressed to the 40 mm; minigun; 2.75 inch rockets; the 20 mm cannon; and tube-launched, optically-tracked, wire-guided (TOW) missiles. We have certainly come a long way.

Remember the "Pump, reciprocating arm wearer-outer, backbreaker"? Well, we are working on the forward area refueling and rearming point (FARRP) and all its associated equipment. With all this sophisticated equipment, we have made great strides in the safety field as well. The days of scrounging the Air Force's old helmets are gone and NOMEX is something that really is a comfort to anyone who has seen or experienced in any way an aircraft fire.

I could go on and on and I am sure that a lot of you have your own pet aspects of this "background" discussion that you would like to add to the list. It's sufficient to say that the name of the game has definitely changed when you consider the way our aviators are equipped today.

Now what about the experience of our aviators in the 1950s. It was all about the same if you were a commissioned officer. You were fixed and rotary wing rated with an instrument ticket and you had "X" number of hours that you had accumulated in various assignments in the States, Korea and Europe. A pretty varied fare with the occasional trip to Alaska, the Far East, South America or the Mid East thrown in for additional spice.

There weren't that many different aircraft in the inventory and they weren't that sophisticated. Not only were some of us qualified in all of the aircraft in the inventory, we were current too. The point made is that we were all basically exposed to the same types of flying assignments and you could look at a man's total flying time and know just about what his experience was.

Skills? A good many of our aircraft and a good many of our aviators weren't instrument qualified. In the late 1950s a drive was initiated to get all of us an instrument ticket; but to many, IFR meant "I Follow Railroads" not instrument flight rules. Most of us got around with roadmaps, sectionals and world aeronautical charts. Dead reckoning navigation was more than just an historical means of getting from one place to another. We actually used it because these were the days before an ADF (automatic direction finder) in an L-19 (O-1) and it was too much trouble to run that manual loop. (Besides, it only had frequencies that were well below the commercial broadcast band, so why bother?)

I believe that we were all a little bit better skilled in the organizational maintenance of our birds. I can remember too many times changing plugs in an OH-13 and it wasn't uncommon to see an Army aviator with a socket wrench

or two sticking out of his slightly ragged flight suit.

We were proficient in one aspect of the profession that I am afraid may be falling into disuse and that is the ability to live with and collocate with the troops in the field or maneuver area or wherever the troop units happen to be located. Sure we were refueling out of 55-gallon drums with that beautiful pump and we were running that *XXXXXXX* Herman Nelson heater on cold mornings, but, we were there. We weren't sitting back at the airfield going home at night while the ground commander was out in the field.

A few years ago in Europe, I asked a captain, brigade flight section leader, if he ever went to the field. "No sir, I don't even have any field gear."

When I asked where his field gear was, he responded, "I turned it all in. I don't need it because I don't ever go to the field."

I hope that attitude isn't the prevailing one.

Another skill that I believe all the commissioned aviators had was the ability to provide staff recommendations concerning the use of all types of Army aviation. Even when we were out there with our regiment or battle group with just an L-19 or an OH-13, the commander turned to us for advice and recommendations concerning the use of cargo capabilities, troop lifts, long range reconnaissance patrol insertions, etc. Because of the limited amount of equipment in the inventory most of us were well familiar with the capabilities and limitations of our aircraft.

So much for the background and the reminiscing. How about today? What are those skills and experiences that figure in Webster's definition of a professional. Let me talk about experience first.

Can we still go to a man's 759 and check out his total time? No way! The 759 is a useful tool in determining an aviator's flying experience but even it is not good enough by itself. Sure you can see what types and models of aircraft he is qualified in and how much of what type time he has and whether or not he has an instrument ticket.

Look at some of the things that you have to dig through to find out though. Was all of the man's 3,500 hours of flying time *southeast time*? (That's Southeast Asia or Southeast United States.) Has he ever seen that cold white stuff blowing by or even worse, that rimey stuffy sticking to his wings? Will he need special help in your area regarding weather and terrain? Is the vast majority of his flying time "follow the leader" time as number 4 ship in the gaggle? How much of the time was he really "on his own" in that decision-making seat?

It takes more than a cursory look at his 759 and it takes even more: a look at his 66 to see what type assignments and responsibilities he has had; how many prefix 6 and prefix X assignments he had that may not have produced many hours but did produce a wealth of experience. Are there any other aspects of experience that have to be considered in developing a look at an aviator's total experience? You bet. How about his civilian schooling?

There are many opportunities offered today for a man to develop himself professionally in the area of civilian education. Any more? There may very well be and the only way that you are going to be able to fully explore an aviator's experience is to talk with him, fly with him and get to know all you can about him.

What about the skills that we are looking for in an Army aviator? Do we want an airline pilot? Do we want a cropduster or a stunt pilot? I don't think so but we do need some of the attributes of all three. I took an instrument checkride the other day and my very sincere and dedicated examiner bemoaned the fact that a good checkride couldn't be given under actual instrument conditions because it's "all too easy now."

What have we spent all that money on to make instrument flying not only easier but even more importantly, safer? I'm not just talking about the Army's efforts but the Federal Aviation Administration's as well. It's pretty easy considering all the radar that we have available and all the approaches. However, since I am restricted to flying a [single engine, fixed wing] T-41, I really find it hard to justify wringing me out and making me prove that I really do deserve that Master Army Aviator Badge. Is it necessary to have an annual examination to see whether or not I can do something that I never intend to do in an aircraft that isn't qualified to do it in? (Pardon my grammar.) I even had to identify an intersection with a fixed card on my ADF because it was "broken."

Is it really logical, or a measurement of an aviator's professionalism to see whether he can do an ADF approach using a null on a nondirectional radio beacon? It makes just about as much sense as qualifying an AH-1 HueyCobra jock by putting him in an OH-13 with those 30 cals strapped to the skids.

How about the cropduster? Do we want to train a man to buzz, if you will excuse that ancient expression? Nap-of-the-earth (NOE)/terrain flying techniques are here to stay. Flying low is one aspect of that method of getting to B from A but not all of it by a long shot. TC 1-15, "Nap-Of-The-Earth Flight Training," has a fine, well-balanced approach to NOE. You have to be intimately familiar with the threat; you have to be able to exploit the intelligence available to you; you have to be able to plan your flight to make the best use of the terrain available; perhaps you have to plan on blocking the ene-

my's target acquisition capabilities with smoke, chaff or electronic warfare.

You may have to suppress certain areas that have an identified threat and be prepared to suppress those areas that may be a problem. We don't need people who just naturally fly under wires and at 10 feet and 40 knots. We need people who can tell when that is necessary and when it isn't. You need to exploit your advantage of speed whenever you can do it without exposing yourself unduly. Those stunt flyers we don't need either.

Popping up, taking evasive maneuvers both have their places but again only when the professional has made a judgment that these tactics are appropriate and necessary.

What skills do we need now? Let me give you an abbreviated list: low level navigation skills; terrain flying skills; artillery adjustment at low level skills; target acquisition and handoff skills; the ability to collocate with troop units; gunnery skills; survival, escape and evasion skills; and finally the skill of being able to get it all together at the right time, *when it really counts—during daylight or after sunset.*

I've taken a cheap shot at instrument qualifications and that deserves a little explanation. I believe that instrument flying and proficiency really discipline an aviator; it is an easily measurable skill; it is considered a mark of a professional by our Air Force and civilian wearers of wings. But, what I am concerned with is the degree of emphasis that we are placing on this skill.

In the next few years, I can foresee a reduction in the number of hours that each aviator will have available to him annually. The energy crisis and the money crunch are undoubtedly here to stay. I maintain that we should *require* that instrument ticket only for those who actually require it in their day-to-day performance of duty or in a contingency role. Let those who *desire* to maintain that proficiency do so at the expense of some other type of flying. Let the other aviators spend their time developing those skills that they will require to accomplish their mission. We all acknowledge that most of us will exist on the battlefield only at NOE. Spend that instrument proficiency time NOEing!

I'd rather see a group of light observation helicopter aviators poring over a 1/250,000 than an approach plate for a back-course ILS (instrument landing system). I know that this is heresy to all our U-21/VIP pilots but let 'em yell. Just keep me current enough to encounter and survive an inadvertent IFR situation. (There will be a regiment of instrument examiners that will rise to this one.) If we need an annual checkride, give out an NOE ticket. If we need the discipline, let's discipline ourselves at the very demanding practice of NOE.

I don't believe we can afford to spend time, effort or money on polishing a skill that we won't all use on the battlefield. If we are going to fly IFR it won't be like my last instrument checkride.

Let's recognize the mark of a professional Army aviator as how well he does the job that he will be required to accomplish in combat, in the environment with which he will be faced and not the size of his hat, the shape of his belt buckle, the shine on his spurs, the number of his civilian ratings or his air transport rating.

ABC Resumes Flight Testing

Sikorsky Aircraft's Advancing Blade Concept (ABC) research helicopter, the XH-59A, has made a brief flight marking the beginning of a two-year period of tests designed to evaluate the advanced rotor system.

The test program, initially begun in 1973, is being conducted under an $8.1 million contract from the U.S. Army's Air Mobility Research and Development Laboratory (AMRDL) at Fort Eustis, VA.

The original test program was temporarily suspended in August 1973, after one of the two ABC aircraft was damaged in a flight accident. Detailed investigation led to a number of design changes and the installation of modified control system.

The ABC rotor system consists of two co-axial, counter-rotating rotors that are rigidly mounted to the rotor hub. The system eliminates the need for a conventional torque-countering tail rotor and its related gearboxes, drive shafts and other components.

The research aircraft will be flown initially as a pure helicopter and later with jet engines installed for high speed auxiliary propulsion testing. Ground tests, wind tunnel and analytical studies have been conducted to investigate and substantiate the flight-worthiness of the helicopter.

The British View

Continued from page 5

Both the team leader and section commander will always have a nominated replacement within the team.

The team radio communication system is based on the standard three radio aircraft fit and is used as follows:

- *VHF(FM)* is mainly used for contact between the team leader, surveillance helicopter and the troops being supported. The team leader also uses it for the passage of periodic situation reports to his parent aviation command post (CP). A nominated member of the team is responsible for notifying ground troops who will be overflown during the movements of the team and he too uses VHF(FM).
- *VHF(AM)* is the primary means of communication within the team and between it and the allocated surveillance helicopters.
- *UHF* (12 preset channels) in British Army aviation is used primarily for local landing zone air traffic control but can, of course, be used to back up the VHF(AM) should frequency allocation allow.

The Engagement Area

An engagement area is considered to be the area between the fire position and the maximum range at which engagement of enemy armour is expected.

In view of the fact that the soft and vulnerable helicopter will be engaging hard and hard-hitting targets the fire position must allow the helicopter to use its weapons to maximum effect and to achieve a high degree of protection.

There always will be the inevitable conflict between the need to stand off at maximum range and the requirement to be exposed for the shortest possible time.

Without doubt, movement is the greatest enemy of concealment and should be reduced to the absolute minimum. To achieve this it is essential that the fire position be considered part of an ambush plan which allows the helicopters to fight on ground of their own choosing and to wait for the enemy armour to enter the ambush area. This can only be done with detailed reconnaissance, a subject dealt with later.

As with all antitank weapons the basic requirement is that the fire position must cover the probable axes of advance. The ground must be such as to ensure that there is little danger of the target disappearing during the time of missile flight.

It is possible to make an enormous list of the requirements for the ideal fire position; it would include all those items required by a ground antitank weapon plus the extra ones needed for the helicopter.

Suffice it to say that the chances of finding the perfect fire position are slight and the average one is usually a compromise.

Types of Engagement Areas

Whilst it is most unlikely that any two engagement areas will be exactly similar, they do tend to fall into three distinct types. These are: *linear, frontal* and *depth*. Each will be discussed with the aid of diagrams.

The *linear* type of engagement is designed to take the enemy in the flank and is particularly applicable to close country where the main routes run up narrow valleys. A typical example is shown in figure 1. Although this figure shows helicopters on one side of the route only, there is no reason (given suitable terrain) why fire positions should not be occupied on both sides.

As this type of engagement probably offers the best chance of a rapid kill rate; its advantages and disadvantages are discussed in some detail.

Advantages: Targets are broadside on offering the maximum target area.

The range for all helicopters will be fairly similar and it is possible to wait until each fire position has a target in range before opening fire, thus achieving a salvo effect.

Salvo effect produces the maximum surprise and rapid destruction. Because all helicopters are in action simultaneously, enemy retailatory action is dispersed and the kill/loss ratio of tanks to helicopters should be greatly improved.

Good background cover is usually attainable.

The helicopters can frequently operate over ground which is unsuitable for infiltration by enemy ground vehicles.

Disadvantages: It may often be necessary to accept less than the maximum missile range.

Helicopters may be subject to strong crosswinds.

Manoeuvre in the face of attack by enemy jet aircraft may be restricted.

Extrication after the engagement may prove more difficult.

The missile flare and burning propellant may be readily visible from a flank. This can lead to the enemy quickly deducing roughly where it was fired from.

A special lookout for threats from the flank and rear will be necessary.

The *frontal* engagement is normally brought about by reasonably open country containing a number of

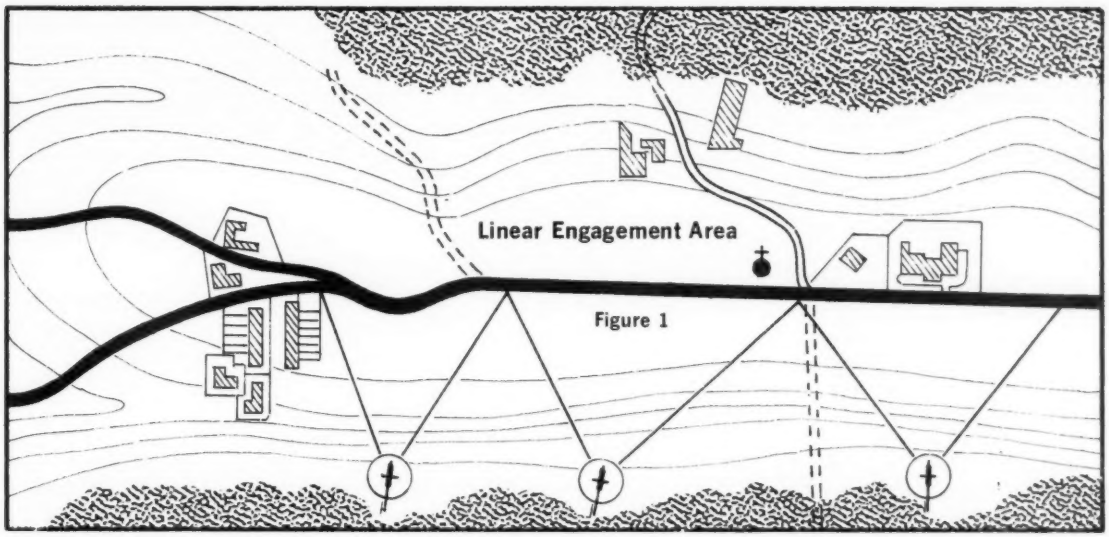


Figure 1

routes fairly close together which the enemy may take. An example is shown in figure 2 (page 14).

With this type of terrain it is necessary to select as many spare firing positions as possible so that, should the enemy use only one of the routes, maximum effort can be quickly diverted to it.

The *depth* type of engagement usually occurs where there is only one clearly defined route and a shortage of fire position from which to take it on from the flank (figure 3, page 15).

This type engagement does of course suffer from the serious disadvantage that the enemy could concentrate his retaliatory fire on small groups of helicopters in turn. However, it does have the advantage that the helicopter attacks are sustained.

Reconnaissance

As was established earlier, the antitank helicopter is regarded mainly as an antipenetration weapon which operates from ambush on ground of its own choosing.

It follows therefore that detailed reconnaissance of the areas of engagement is a prerequisite of success.

Reconnaissance falls into two categories – *deliberate* and *quick*.

Deliberate reconnaissance is the responsibility of the antitank flight commander in whose operational area the engagement areas fall.

It is part of contingency planning and is based on the staff appreciation of the possible axes of enemy penetration and which would be the most dangerous should they occur.

The actual reconnaissances are undertaken prior to the arrival of enemy forces in the proposed engagement areas. Much attention is given to looking at the proposed fire position from the enemy's point of view, thereby ensuring that the very best possible concealment is achieved. Results of the reconnaissance are circulated by map trace and SOP (standard operating procedures) proforma.

No matter how carefully plans are made the unexpected will frequently occur and antitank helicopters may have to be committed without deliberate reconnaissance.

Some warning of the enemy's activities will however have been given because penetrations do not occur instantly; therefore, a *quick reconnaissance* will be carried out by the nominated team leader in depth on the axes of penetration.

Though this is an emergency procedure intended to contain an advancing enemy, the team leader must ensure that he takes full account of the factors listed below if a successful engagement without undue loss of helicopters is to be achieved:

- Rate of advance of the enemy.
- Achieving maximum engagement range.
- Time taken by the fire team to occupy its firing positions.

It can readily be seen that given an enemy of normal mobility the area chosen must be in some considerable depth.

Although it might seem that in this situation the surveillance helicopter should be able to do the reconnaissance, experience has shown that its other commitments will not allow it to do so.

The Surveillance Helicopter

Having stated above that surveillance helicopters cannot undertake fire position reconnaissance, let us now examine what their functions are.

The Bell 47-G Sioux is the main light observation helicopter in service. The U.S. Army OH-13 is the same aircraft

It will become apparent that the success of the whole operation largely will depend on the actions of the surveillance helicopters when their responsibilities listed below are examined:

Before The Engagement

- Shadowing and reporting enemy movement.
- Harrassing the enemy by direct artillery fire.
- Obtaining clearance for the team to open fire.
- Briefing and updating the team.

During The Engagement

- Telling the team when to adopt firing positions.
- Maintaining general lookout for enemy air and ground threats.
- Providing overall assessment of enemy activities and any unexpected changes in this.

Between Engagements

- Maintaining contact with the enemy.
- Updating the incoming team.

In order to carry out these tasks surveillance helicopters are usually deployed well in advance of a developing threat. They may well have already been working with the forward troops on routine aviation tasks and undertake the task of surveillance as the threat develops.

In order to ensure that the fire team realizes its full flexibility and achieves maximum speed into action a system of clear cut and unambigious orders is necessary.

The limited number of missiles carried also emphasizes the need to ensure that missiles are not wasted by two helicopters engaging the same target, a problem made worse by the long flight time of current missiles.

Fire sections are allotted clearly defined sectors of responsibility in the normal military manner using prominent features to deliniate between them. These are designated inclusive or exclusive as appropriate. A typical allocation would be as in figure 4.

Designation Within The Fire Section

It is important that within the fire section each helicopter is given its own individual target(s) to ensure that two helicopters do not engage the same target. There is a variety of methods laid down for target designation and which method is used will depend upon the type of engagement area and the formation adopted by the enemy.

Fire Control Orders

Fire control orders must be kept absolutely simple; listed below are the four used by the British Army:

- In your own time.
- At my command (followed by "Fire").
- Stop firing.
- Report when firing.

The first three are self explanatory. Report when firing is used when there is a danger of a helicopter capturing a missile fired by another aircraft closely adjacent to it.

The nominated helicopters will report "firing now" when they are about to fire. This can be inhibiting and can normally be avoided by proper helicopter separation and target designation orders.

Moving To Firing Position

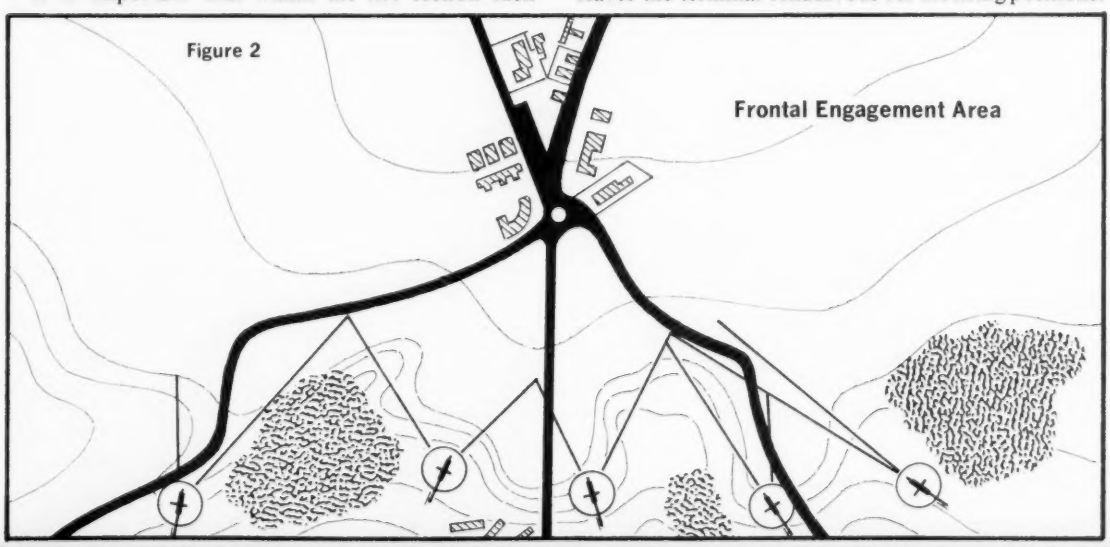
The movement forward to the firing positions is made according to the threat of the moment. Particular attention is paid to the following:

Height. Below fighter aircraft sweep height, but high enough to permit the use of the high speed of the helicopter during the early stages of the move forward.

Routes. Normal forward area route planning applies but the route is broken up using a number of intermediate rendezvous and a final terminal rendezvous from which the helicopters will deploy to their fire positions, guided as necessary by the team leader. The intermediate rendezvous serve as a convenient position reporting system and acts as rallying points should the team be forced to disperse enroute.

It is normal practice for the surveillance helicopters to come under command of the team leader when he leaves the terminal rendezvous for the firing positions.

Figure 2



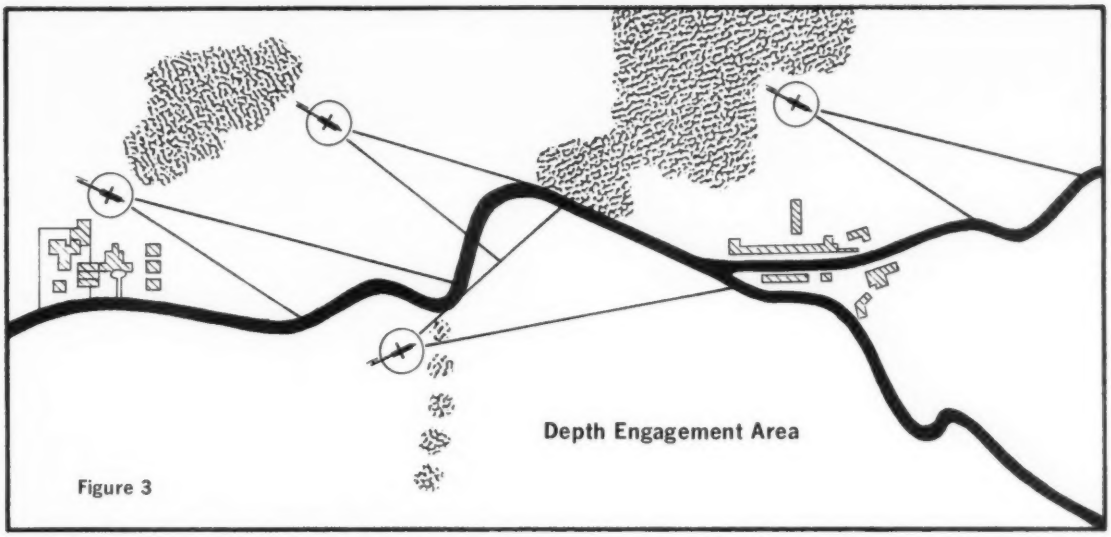


Figure 3

Updating. As previously mentioned it is one of the primary duties of the surveillance helicopter to update the team leader as he moves forward. It is at this stage that changes are most likely to be necessary and when the team leader needs to be tactically flexible and fast thinking. The probability of changes being necessary emphasizes the need for the team leader to be free of aircrew duties and able to concentrate fully on his command and control functions.

Contact with ground troops. As the team flies forward the nominated member makes contact with any troops likely to be overflown enroute. This achieves two things – firstly it ensures that current information is available to the team and secondly that it is not fired upon by tense and battle-weary troops whose aircraft identification may not be of the best.

Downed aircraft. Any member of the team seeing another go down will give the normal report to his leader or the aviation CP on VHF(FM). The rest of the team will continue with its mission.

The Engagement

It is extremely difficult to portray an engagement but the following is a likely sequence, starting from occupation of the engagement area.

The fire team leader will point out the section areas and, if he has not previously done so, order which method of fire control is to be used. Section commanders site individual helicopters and give them target designation. When all helicopters are in position the fire team leader so informs the surveillance helicopter pilot who has meanwhile been keeping the fire team leader updated on enemy progress.

When enemy tanks are within range the engagement starts and helicopters, within the limitations of target designation and fire control orders, engage on their own initiative.

The fire team leader will, where necessary, adjust section positions to meet any changes in threat and will decide when sections are to break off the engagement and to begin the subsequent action. This may either be to occupy fresh positions or to withdraw to rearm or refuel.

Training

All aviation skills and techniques require continuation training but there can be no doubt that the anti-tank task is the most demanding of all and therefore requires a great deal of the training time available.

A number of subjects will require special emphasis during individual continuation training.

Aircrew: Pilots and aircrewmen will need intensive training in the following:

- Low level navigation and map reading.
- Observation and reconnaissance.
- Enemy equipment and tactics.
- Range estimation.
- Selection of fire positions.

Pilots:

- Tactical low flying.
- Formation flying.
- High AUW (all up weight) operations.
- Out of wind operations.

Air gunners need continuous practice of their target acquisition skills by use of a simulator.

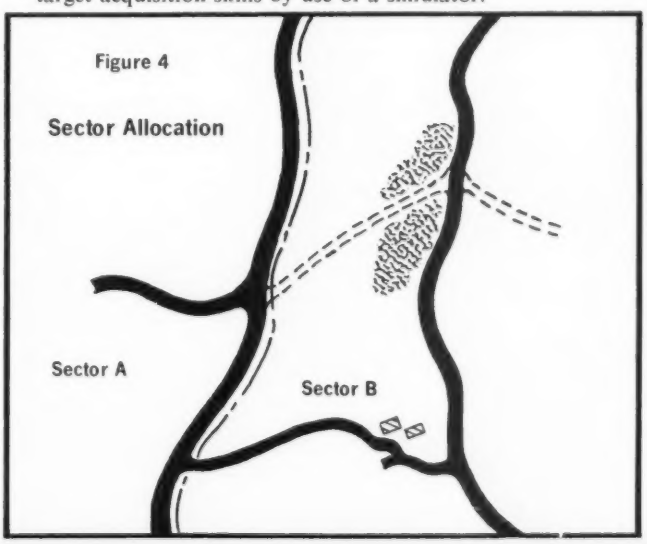


Figure 4

The Anglo French Gazelle is replacing the 47-G Sioux. It has much greater speed, load capacity, endurance and agility

Fire Team Training

Fire team training should give emphasis to *accurate timings*. This is probably the most critical factor of all given the limited endurance of current helicopters. Fire team leaders must be extensively practiced in planning their engagement and complex situations presented to them which require radical changes of plan and constant awareness of their team's fuel state.

Concerning the *flight pattern* it is essential that fire teams fly at best speed on a well-chosen route until coming within possible range of radar controlled weapons and then adapt their flight accordingly.

Tactical formation flying is the basic requirement for flight forward to the engagement area.

Action if attacked training is needed to ensure that standard operating procedure's evasion drills and rendezvous procedures work correctly.

Stealth in the Forward Area also is important since the successful occupation of a fire position normally requires stealth and field craft. Ground observers in the target area should be provided for this exercise.

Once chosen, the *Suitability of Fire Positions* should be viewed and criticised from the enemy's point of view.

Areas of Fire/Target Allocation must be coordinated so that there is no ambiguity or misunderstanding by individual helicopter crews of their areas of responsibility. This can best be checked by rising above cover after the low level allocation of arcs and thereby obtaining a better plan view of the area.

Range is quite critical. The target must be in range. This is best checked by a rangefinder but in the current absence of such a device careful map reading and close cooperation with ground observers will provide accurate answers.

Any light helicopter working in the forward area can find himself acting in the *surveillance role* for a fire team.

It is essential therefore that SOPs are fully understood and the aircrew well practiced in the following:

- Adjustment of artillery fire.
- Updating of the fire team.
- Accurate time assessment with regard to enemy movement.
- Flank protection and watching for hostile aircraft.

Conclusion

Our helicopters are in short supply and it is therefore necessary that they be capable of more than one type of task. In view of this the standard utility helicopter is expected to perform normal missions prior to its being dedicated to the antitank role. It also will revert to these after the threat has passed or should its antitank equipment become damaged beyond repair or whilst awaiting its replacement.

Present indications are that future wars, even in Europe, will be short and sharp.

In this context it is essential that the peacetime tactical training of aircrews be as realistic and comprehensive as possible. In particular they must have full confidence in the tactics and techniques associated with the equipment which they have now. They must not be looking over their shoulders waiting for the arrival of a magic black box which may or may not come in time.

They must understand that they operate a battlefield vehicle which though having some tremendous advantages over others is highly vulnerable if incorrectly operated. Aircrews require as much stealth, battlecraft and reconnaissance expertise as any other arm in close contact with the enemy, for without it they will not survive.

It should always be remembered that the learn time available to those that followed on in other wars is unlikely to be available next time, and that élan and courage alone will not suffice against the highly sophisticated means which are likely to be deployed against us.

Lieutenant Colonel Woodford joined the British Army in 1946. After basic training in the Infantry he went to the Royal Military Academy, Sandhurst, graduating to the Royal Artillery in 1948. He has served in numerous countries on the Continent, in the Mediterranean and in the Far East. The author is a dual rated aviator; he earned his wings in 1956 and the rotary wing rating in 1968. LTC Woodford was appointed Commander of Army Aviation Hong Kong prior to his current duty as British Liaison Officer at the U.S. Army Aviation Center, Ft. Rucker

Tactical Instruments

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WHAT DOES THE term "tactical instruments" mean to you? Unless you are currently instructing students at the U.S. Army Aviation Center (USAAVNC), Ft. Rucker, it probably brings to mind such maneuvers as ADF (automatic direction finder) figure eight approaches and basic instrument proficiency required for a tactical instrument rating. Of course, today all aviators are required to have and maintain a standard instrument rating. And, tactical use of instruments has taken a back seat to Department of Defense and Federal Aviation Administration instrument procedures generated for a "state-side" environment and mostly oriented toward fixed wing aircraft.

But what about the combat environment? How often did you have the opportunity to "shoot" a published VOR (very high frequency omnidirectional range) or ILS (instrument landing system) approach in the Republic of Vietnam as a combat rotary wing pilot? How many times did you receive an urgent mission to perform during adverse weather conditions in territory where there were no receivable NAVAIDS (navigational aids) let alone any published approach procedures? How many important missions were cancelled due to weather? These are questions which you can answer on an individual basis, but beyond that: what about future combat operations?

Experience gained from the 1973 Mideast War indicates that aviation units must be capable of full-scale night deployment and also have the ability to handle missions during adverse weather conditions. But what happens when an aviator goes IFR (instrument flight rules) to accomplish the mission? How does he get back down to VFR (visual flight rules) conditions when he is operating in a combat situation where there are no published approaches and only a minimum number of tactical NAVAIDS? Consider the situation described below.

A tactical emergency (Tac E) has just been declared! Several general outposts along the GOPL (general outpost line) have received heavy sustained fire during the night and are expected to be overrun in the morning hours. You have been given the mission to proceed with attack helicopters to provide enroute fire supression to a location just inside the FEBA (forward edge of the battle area) where you will continue at nap-of-the-earth (NOE) altitudes to the general outpost and perform the extraction.

Your base field is located about 50 miles from the FEBA and it is an additional 10 miles to the GOPL. The weather is IFR and 5 miles out from the base field you encounter "zero-zero" conditions which cannot be circumnavigated or waited out.

You have radio contact with the unit located on the FEBA which reports 200 to 300 feet and overcast. Is this where the mission ends due to weather? The guys on the ground will just have to make arrangements to get flown away during better weather conditions!

Right? Wrong!

Through use of a tactical letdown using only the limited tactical ADFs in and around the battlefield, you can plan yourself an approach to VFR conditions in the proximity of the unit forecasting the improved weather conditions.

Let's examine another situation. Assume you have accomplished the extraction and are proceeding back to the FEBA. Due to the extended length of the mission and high power settings required during NOE operations, you determine that you will not have enough fuel to make it back to your base field – which may or may not have instrument approach procedures.

After passing the FEBA, the weather deteriorates to "zero-zero." What can you do now? You have three choices, none of which will be an easy decision:

- You can put the aircraft down and "beat feet" to friendly positions, depending on the distance involved.
- You can land and try to wait out the conditions in "no-man's land."
- You can chance going IFR and plan a tactical approach to a friendly area where you can wait for fuel.

Of course, a choice to go IFR at this point involves altitudes which are hazardous to your health in a high threat environment where sophisticated surveillance and detection radar are employed. But it very well may be your best alternative. In these situations, employment of tactical instruments might save your life and the lives of your crew and passengers.

The U.S. Army Aviation Center welcomes your ideas pertaining to future development of tactical instrument procedures. Replies should be sent to:
Department of Undergraduate Flight Training
ATTN: ATZQ-T-UFT-AD
Fort Rucker, AL 36362

Once you have established the need for transition from IFR to VFR conditions with only minimal NAVAIDS, what procedures can be employed to accomplish the transition?

The Advanced Division of the Department of Undergraduate Flight Training at USAAVNC is researching new ideas and solutions to this problem. There are two "tactical approaches" presented to the initial entry rotary wing student. These are by no means the only – or even the best – way of accomplishing the transition under field conditions. They are two approaches or solutions to an existing problem for which the Army now has no procedures. But the student (soon to be a rated aviator) is provided with a method he might employ if the situation dictates that he go IFR in field conditions on future battlefields.

The first of the two approaches is termed the ***tactical instrument letdown***. NAVAIDS necessary to accomplish this approach are any two receivable beacon facilities which can be tactical ADF facilities or VOR if available. The advantage of this approach is that is is a "point in space" procedure which can be plotted to terminate anywhere as long as you are in reception distance of two NAVAIDS. Although somewhat detailed, the procedure could be planned and executed with only the least amount of planning in the cockpit, if necessary.

To plan the approach the pilot plots an approach corridor to the beacon facility he wishes to use for "letdown" to VFR conditions. This corridor should be a minimum of 2,000 meters wide or 1,000 meters either side of center line. A thorough map reconnaissance should be conducted to determine the highest obstacle within the *entire* approach corridor. All subsequent approach altitudes will be based on "height above" that obstacle.

The pilot chooses a beacon facility which will enable him to receive the most reliable and accurate intersections along the approach corridor. He should plot three intersections thus dividing the corridor into four sectors of equal length. Each will have an assigned altitude above the highest obstacle in the corridor.

During the approach, the pilot establishes his aircraft on the course line prior to the first intersection. At the first intersection the pilot descends to 400 feet AHO (above the highest obstacle in the *entire* corridor). At the second intersection the pilot descends to 300 feet AHO. He then proceeds at this altitude until reaching the third intersection where he descends to 200 feet AHO. If VFR conditions are not established at this time, the pilot executes a missed approach with a climbing turn in the direction of the lowest terrain.

The lowest descent altitude (200 feet AHO) compensates for both altimeter error and lack of altimeter setting. The approach corridor, as well as sections of the approach corridor, may be of any length the pilot chooses, but should allow ample time for descents, radio tuning and other unforeseeable circumstances. The key to the successful performance of this maneuver lies in adequate planning and preparation.

The second of the two approaches is termed, for lack of a better name, the ***tactical circling letdown***. This approach can be performed with the use of only one tactical beacon. Additionally, the circling approach better utilizes the inherent capabilities of the helicopter in comparison with fixed wing approaches.

To plan the approach the pilot chooses the beacon facility he wishes to use for "letdown" to VFR conditions. After choosing the beacon he plots a "buffer" zone which extends 2,000 meters from the beacon in any direction. An expeditious means to plot the buffer zone is to draw a square with equal sides of 4,000 meters with the beacon at the center. Once this is accomplished, the pilot conducts a thorough map reconnaissance to determine the highest obstacle within that buffer zone. The pilot adds 200 feet to the highest obstacle altitude

Tactical Instrument Letdown

Choose letdown beacon
Plan approach corridor 2,000 m wide
Conduct thorough map reconnaisance
Determine highest obstacle within corridor
Select beacon for intersections along corridor
Plot three intersections (will result in four sectors)
Fly to arrive at:
- **Intersection I 400 ft above highest obstacle (AHO)**
- **Intersection II 300 ft AHO**
- **Intersection III 200 ft AHO**

If not VFR, execute missed approach with climbing turn in direction of lowest terrain

and that altitude becomes his MDA (minimum descent altitude).

The pilot tracks to the beacon at an altitude no higher than 800 feet AHO from whatever direction he chooses. This altitude affords minimum exposure time to existing wind conditions during the approach.

Upon indication of station passage, the pilot simultaneously decelerates to 60 knots and begins a turn (right or left) using a 15 to 20-degree bank. He reduces power to establish a 300 FPM (feet per minute) rate of descent and continues his turn. The copilot performs a prelanding check and notifies the pilot when approaching the MDA. The pilot continues the descent and turn and upon establishing VFR conditions immediately descends to NOE altitude, adjusting his airspeed as necessary. If VFR conditions are not established before or upon reaching his MDA, the pilot continues to turn and applies power as necessary to achieve a 500 FPM rate of climb. The climbing turn is continued until reaching a safe altitude, at which time the pilot continues to another facility.

This approach has been conducted under various wind conditions and it has been found that the actual diameter of the circle will not exceed 1,000 meters, even under adverse wind conditions. The pilot should be aware, however, that 60 knots and a 15 to 20-degree angle of bank controls the radius of the circle and should be strictly adhered to. Additionally, it appears that existing wind conditions have little effect in actually "moving" the circle. This approach has been tested under varying wind conditions.

Currently, flight tests are being conducted to determine the applications of this maneuver with FM (frequency modulation) homing for circling letdown. There are some problems involved in determining station passage and possible solutions are being researched. Also, applications are being studied with respect to the use of radar facilities in flying to a point where the circling letdown can be conducted. Aviators will be notified of the progress of the tests. With proper planning, this approach could provide still another method for transition to VFR conditions in emergency situations.

It should be emphasized that both of these approaches represent only two possible solutions to an existing problem for which there are no published solutions.

The changing role of Army aviation on the modern battlefield requires a continuing evaluation and updating of aviator skills and technology. We as aviators should be prepared to face any emergency which we may encounter now or in the future.

Tactical Circling Letdown

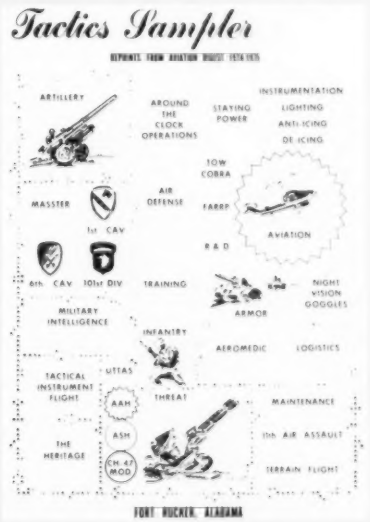
Select one letdown beacon
Plot buffer zone 2,000 m from beacon in all directions
Do a thorough map recon of buffer zone
Find highest obstacle within zone
MDA (minimum descent altitude) will be 200 ft AHO
Flight technique:
- **Track to beacon no higher than 800 ft AHO**
- **On station passage simultaneously reduce to 60 Kts**
- **Begin a turn using 15 to 20 degrees bank**
- **Reduce power for 300 fpm descent**
- **Continue turns over station and descent until MDA**

If not VFR apply power for 500 fpm climbing turn until safe altitude

The author has completed the Armor Officer's Basic Course and is a dual rated aviator with more than 2,000 flight hours. Captain Carmichael is conducting research into practical applications of tactical instrument approaches. He has a M. Sc. degree in counseling and guidance from Troy State University, Ft. Rucker

The *DIGEST* has available copies of the recently compiled "Tactics Sampler." Interested aviators and commanders, both active duty and reserve may obtain copies by writing to:

Editor
U.S. ARMY AVIATION DIGEST
P.O. Drawer P
Ft. Rucker, AL 36362



Continued from page 7

SS-11 ATGM. The semiautomatic HOT system requires only that the operator maintain the target in his view screen; the missile is automatically tracked.

The HOT system can be installed on most helicopters. It has been undergoing tests in France and West Germany for some time, and now is being operationally installed on the French Gazelle helicopter (figure 2) and on the West German BO-105 (figure 3). A more complete breakout of the major components of the helicopter-mounted HOT missile system and their interrelationship is depicted in figure 4 on the flow chart (Helicopter-Mounted HOT Missile System Components and their Interrelationship). The weights of a helicopter-mounted 4-missile system are provided in Table 1.

HOT/ATGM System Parameters: Firing may be carried out from the helicopter on the ground, hovering in- or out-of-ground effect, in rectilinear movement up to 200 knots/hours (kn/hr) and through turns up to 6 degrees. The probability of successful operation, hit and kill is 90 percent. HOT also is unobstrusive with low sensitivity to countermeasures and has ammunition (missile) common to both ground and helicopter applications.

HOT has semiautomatic infrared guidance: detection by 3-field infrared locator; guidance unit computes corrections on the basis of miss distances; transmission of corrections over wire; and effective corrective action by jet deflection. Its gyroscopic stabilization consists of a gyrostabilized sight coupled to an IR locator; high-resolution image stabilized 3.2x for a field of 160 milliradian (mrd), and 11.8x for a field of 45 mrd; standard deviation aiming error approximately 0.1 mrd; and an automatic aiming assistance device.

Firing mounts are slaved in elevation, maintaining the missile axis parallel to the aiming axis in an aiming sector of +8 degrees to -12 degrees.

Within the parameters itemized below, the HOT system may be employed without reduction in performance:

- Altitude: 0 to 9,850 meters.
- Temperature: -35 degrees C to +52 degrees C.
- Fire velocity: 0 to 200 kn/hr.

Figure 2

French Gazelle Helicopter armed with 4X HOT ATGM

The Missile and Tube: The HOT ATGM with its transport/launch tube (figure 5) is an assembly of the main components listed below:

An ogival warhead containing a shaped charge and fuze assembly. The warhead (total weight – 13

Figure 3

West German BO-105 Helicopter armed with 6X HOT ATGM

KEY

fps	feet per second
ft	feet
g's	30 times the gravitational pull of the earth
in	inch(es)
kg	kilogram(s)
lb	pound(s)
m	meter(s)
mm	millimeter(s)
sec	second(s)

pounds) contains 6.6 pounds of explosive.

A motor section comprising:

- A solid propellant boost motor which discharges through four booster nozzles at the rear of the missile.
- A solid propellant sustainer motor which discharges through a central tube, passing through the boost motor compartment.

A control and guidance section (figure 6) carrying (externally) the single sustainer jet deflector and the infrared emitting flare; and (internally):

- The single guidance wire bobbin carrying the two guidance wires which are sheathed in one cable.
- Gyroscope.
- Signal decoder unit.
- Self-activating electrical battery for internal power supply.

The weapon is supplied in one standard version (infrared guided), fully assembled with wings folded inside a transport/launcher tube. It can be stored and handled like a standard round of fixed ammunition. The missile is hermetically sealed in the tube and no testing is required prior to firing. The tube is of fiberglass construction that will withstand rigorous handling conditions. A locking device within the tube ensures that the missile is permanently held in position until firing.

Dimensions and weights of HOT ATGM and its transport/launching tube are furnished in Table II. Principal characteristics of the system are found in Table III.

HOT Optical/Infrared Control System: The sketch in figure 7

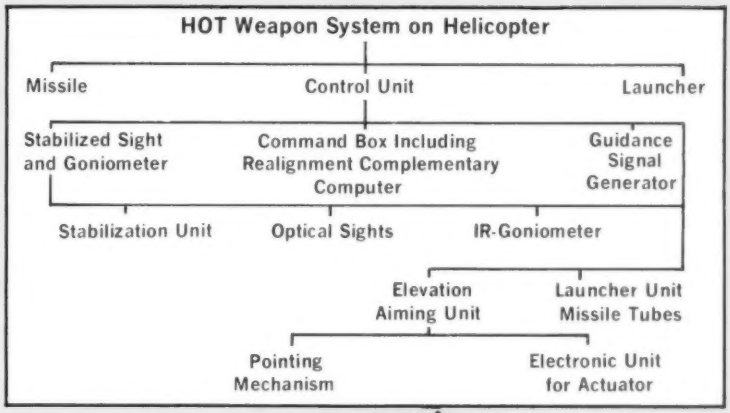


Figure 4

Flow chart of helicopter-mounted HOT antitank missile system components and their interrelationship

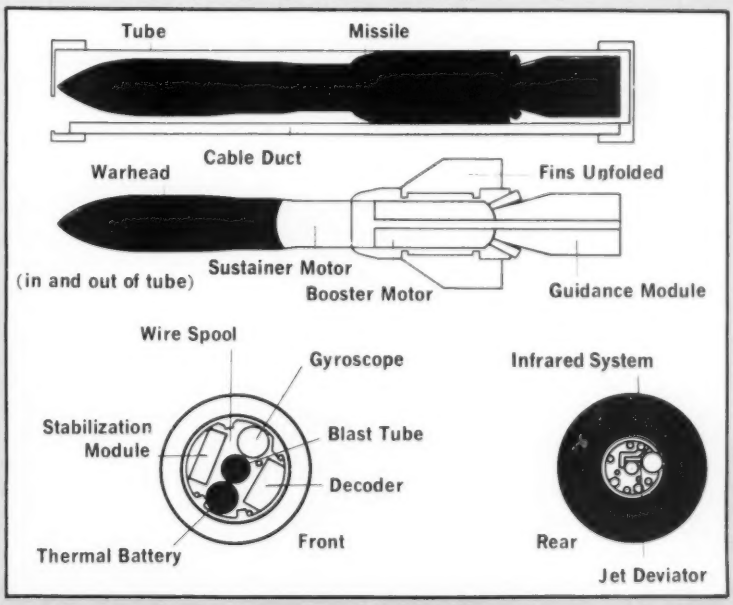
Weights of a Four-Missile Installation

	One Unit		Total (X4)	
Missile prior to launch	(27.2 kg)	60.0 lb	(109.0 kg)	240.0 lb
Tube after missile launch	(5.0 kg)	11.0 lb	(20.0 kg)	44.0 lb
Sight and goniometer	(23.1 kg)	51.0 lb	(23.1 kg)	51.0 lb
Electronics for goniometer	(4.1 kg)	9.0 lb	(4.1 kg)	9.0 lb
Sight control stick	(1.0 kg)	2.2 lb	(1.0 kg)	2.2 lb
Command guidance unit	(9.0 kg)	20.0 lb	(9.0 kg)	20.0 lb
Missile launching assembly	(44.0 kg)	97.0 lb	(44.0 kg)	97.0 lb
Launcher pitch control mechanism	(15.0 kg)	33.0 lb	(15.0 kg)	33.0 lb
Cables and wiring	(5.9 kg)	13.0 lb	(5.9 kg)	13.0 lb
Total weight prior to launch			(211.0 kg)	465.2 lb
Total weight after launch (tubes remaining)			(122.0 kg)	269.2 lb

Table I

Figure 5

Cutaway views of HOT ATGM and its guidance system



Dimensions and Weights

Total weight (missile in tube)	(27.2 kg) 60 lb
Length (less protective cape)	(1,300 mm) 51.2 in
Outside diameter	(175 mm) 6.9 in
Missile as launched (total weight)	(21.8 kg) 48 lb
Warhead	(5.9 kg) 13 lb
High explosive	(3.0 kg) 6.6 lb
Warhead diameter	(137 mm) 5.4 in

Table II

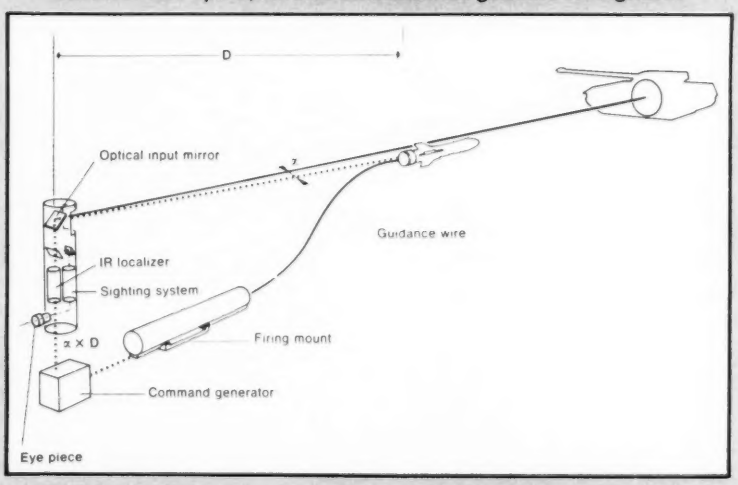
Characteristics

Acceleration at launch	30 g's
Debris (at launch acceleration)	None
Sustainer velocity	855 fps (261 m)
Fuze armed at (from launch point)	81 ft
Minimum effective guidance range:	
with semiautomatic guidance	1,310 ft (400 m)
with manual guidance	2,640 ft (800 m)
Maximum range (varies with altitude and speed of launching aircraft):	
at zero forward launching speed	13,125 ft (4,000 m)
Time of flight to maximum range	16 sec
Circular error probability	1.64 ft (500 mm)

Table III

Figure 6

Sketch of HOT optical/infrared semiautomatic guidance arrangement



depicts the optical/infrared control system for the HOT ATGM. IR radiation from high-powered flares positioned in the rear end of the missile is detected by an IR goniometer whose reference axis is parallel to the optical axis of the operator's sight. This arrangement allows the angular deviation of the missile from the line-of-sight to be measured. This angle, plus the estimated distance traveled by the missile, determines the error between the actual and the desired flight path. This error is used in computing correction signals which are transmitted to the missile by wire to correct its flight path.

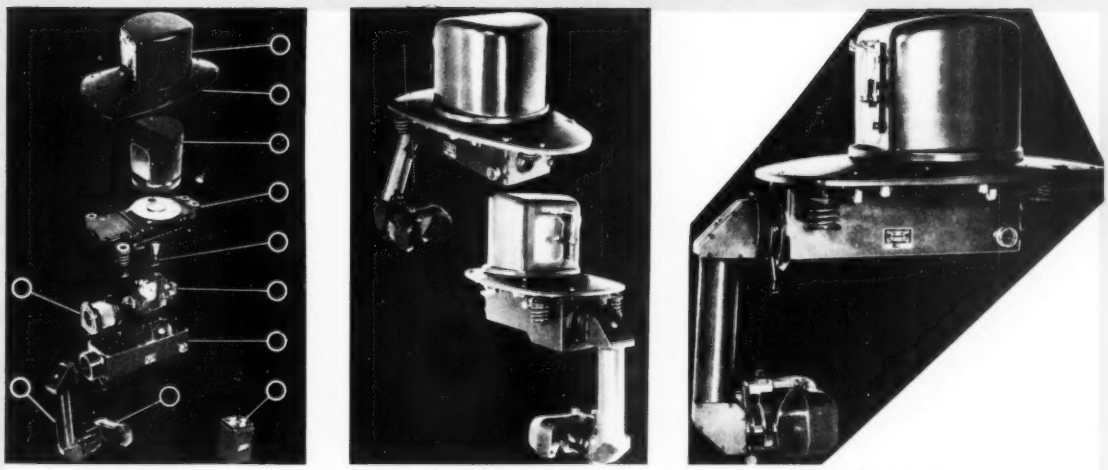
The system combines high-power flares and a wide bandwidth; the developers claim that no tracking difficulties have been experienced during firing tests, even at ranges up to 4,400 meters (total length of guidance wire). Useful range is 4,000 meters.

Stabilized Sight, APX-334 (figure 8): The stabilized sight employed with the helicopter-mounted HOT missile system is the French APX-397 (production model of the APX-334) which imposes the following limits on the system:

- Velocity limits (angular velocity at which the sight can track): 0 to 250 mrd/sec in azimuth; 0 to 200 mrd/sec in elevation.
- Traverse limits: 265 degrees in azimuth; 72 degrees in elevation.

Launcher/Suspension: The launcher moves in elevation but is fixed in bearing, i.e., the helicopter bearing determines the bearing of the launcher. When the missile is launched, the launcher elevation is parallel to the helicopter target in bearing. After launch the missile is automatically guided onto the helicopter target line by a realignment computer.

Weather Minimums: The system's ability to see and track the target determines the weather minimum. If the operator can see the target, HOT's range and accuracy



Exploded View | Front View | Rear View | Side View

Figure 7

The APX-334 stabilized sight system

will not be affected by snow, fog, sleet or other weather phenomena. High velocity winds would naturally create problems for helicopters, but it would take an extremely high wind to consistently force HOT off its intended flight path.

Missile Weight: The launch weight of the HOT missile is 48.5 pounds.

Helicopter Installation Components: The helicopter installation comprises three separate units: stabilized sight and IR detector; command guidance unit and a launching suspension unit.

Stabilized Sight and IR Detector (figure 9):

- The APX-334 stabilized sight system was developed specifically for use with this system. It features + or -120 degrees in azimuth; +30 degrees to -20 degrees in elevation; 400 mrd field, 2.5 magnification; and 100 mrd field, 10.0 magnification.
- IR detector (goniometer) employs the following fields of missile capture and guidance to target: + or -6 degrees from 0 to 1.5 seconds; + or -3 degrees from 1.5 to 3.0 seconds; and + or -0.5 degrees from 3.0 to 16.0 seconds (maximum time of flight).

The Command Guidance Unit is comprised of (1) a missile realignment computer which feeds the necessary information from the helicopter fore-aft axis to the missile in order to bring it into the goniometer field of capture; (2) an indicator of + or -4 degrees with arrow is displayed to the pilot, showing the exact fore-aft position of the helicopter within the field of 8 degrees; and (3) a "go/no go" device; and:

- Flight control stick – manual command guidance.
- General command box.
- Signal generator.
- Main functions selector.
- Missile junction boxes (two).

The Launcher Suspension Unit: Launchers are fixed in azimuth with +15 degrees to -20 degrees in elevation movement. The installation comprises:

- Launching assembly (number will depend on user requirements).
- Electronics for actuator.
- Pitch control mechanism.
- Emergency jettisoning device.

This, then, is the HOT antitank missile system – likely to be the principal helicopter-mounted antitank system in Europe for the next decade or so. In full production now and already operational in some countries, the true capabilities of the system should soon become apparent. To be as successful as its predecessor, the SS-11, it must perform up to all its reported capabilities.

Can the system really reach its 4,000 meter range? In 16 seconds? Is its guidance system effective at this range, or is the IR emitter signal too weak? How effective is this guidance under combat conditions where multiple IR sources may appear in the target area?

HOT's developers say the answers to all the above questions will be favorable to the HOT system, and they have been able to convince their governments and military users; other European countries, including the United Kingdom, are giving the system serious consideration. It seems obvious it must have considerable merit, but we'd like to reserve judgment pending final and complete checkout by persons and countries not involved in its development and sales.

Staying Power Sy

Lighting

Colonel Robert W. Bailey

DURING THIS symposium the problems of cockpit lighting and the key role lighting plays in operational staying power capability were thoroughly reviewed. Users' presentations clearly defined requirements and deficiencies. It also was confirmed that deficiencies that were once only a performance depreciating irritation have, in fact, become a hazard to flight safety and a serious threat to mission accomplishment.

Philosophically, we often find ourselves applying technology in two diametrically opposite directions simultaneously. Night viewing devices that seek to convert the night scene to essentially one of daylight brightness are increasing in sophistication and effectiveness. The effect on the individual is twofold. His visual information capability is enhanced considerably, but simultaneously his innate and trained visual adaptation capability is automatically compromised by the device.

As long as the device works, there is no problem except for the information transfer of the device itself. Technical papers presented during the discussion group sessions provided most encouraging information; that rare earth phosphors, new tube design, lighting and packaging can provide cathode ray tube (CRT) displays and instrument displays that are in fact compatible with maximum visual sensitivity in the event of their failure.

During the conference more than sufficient data were presented to establish that there are solutions to lighting problems available from current technology. Unfortunately, we still have studies being performed that ignore well established

Anti-Ice

Doctor James Kishi

THE MAIN OPERATIONAL requirement is the acquisition of ice protection for helicopters in the current inventory. This protection should be provided with minimum tradeoffs with respect to cost, weight, reliability, maintainability, and infrared (IR) and electronic countermeasures (ECM) detection. The following items are those requiring immediate attention:

- UH-1. Require ice protection retrofit on a selective basis for the windshield, engine inlet and rotor system. There is a need for an ice detection system.
- OH-58. Require ice protection for the windshield and engine. Ice protection for the rotor system was not requested, recognizing the weight limitation and the lack of protection for the AH-1 rotor system. Weight restriction of present aircraft is a serious factor.
- AH-1. Require ice protection for the windshield and canopy, weapon systems and engine inlet. Ice protection for the rotor system was not requested due to input from recent Pass-in-Review. Weight restriction of present aircraft is a serious factor.
- CH-47. Investigate incorporation of ice protection for the upcoming improved rotor blades.
- Radio Antenna. Relocation of FM radio set antenna, where applicable, so that whipping due to ice accumulation will not cause the antenna to strike the airframe or the tail rotor.

The immediate developmental requirements are listed below. Their order does not reflect priority.

- A need to advance technology (e.g., solid-state components, controllers, stepping switches, ice adhesion, ice detectors, rate meters, etc.). Additional research on droplet size and liquid water content.
- An anti-ice/deice design guide for helicopters is needed. The current guide is based on fixed wing.

Instrumentation

Colonel Edward Por

THERE IS A requirement to continue to improve and intensify the tactical instrument training program at the United States Army Aviation Center (USAAVNC) and to provide impetus to field commanders to establish tactical instrument training programs within tactical aviation units.

The next logical step in tactical instrument training is progression from the elementary instruction now given in the tactics phase of initial entry rotary wing (IERW) training. This will require a detailed evaluation of how and what is to be taught in IERW, the rotary wing qualification course (RWQC), and flight examiner courses. Two basic questions must be answered: During instrument qualification, should we continue to teach strictly Federal Aviation Administration (FAA) airway-type instrument flying and concentrate on tactical instrument flying later? Conversely, should we reorient instrument training toward tactical instrument flying at the start?

The seed is planted doctrinally in FM 1-5, but if we are to give impetus to tactical instrument flying Army-wide and answer the questions posed above, ARs 95-63 and 95-1 should be reviewed to determine if changes are necessary

ymposium

also see page 1
"2.75 Inch Rocket Summary"

ley **Commander, Army Aeromedical Research Laboratory, Fort Rucker**

physiological facts and only serve to confuse managers and non-experts. More seriously, these efforts have the adverse potential of compromising operational capability.

Eventually, management decisions must be made to relate human requirements to materiel. Hopefully, managers will select correct answers and opinions from the myriad available. The probability that they may not select the proper advice is a real threat that was not included in the threat briefing our first day.

The resolution of cockpit lighting problems is within the technological and production capability of industry. However, we are not receiving the kind of enlightened decision making that is necessary to translate this technology to operational capability. This could be resolved by increased coordination with appropriate agencies and experts that is not required by existing regulations, but is demanded if we are to resolve this problem. No plan of action is being established to fill this gap. Existing coordinating committees do not have sufficient influence with managerial and materiel acquisition decisions to influence a more effective resolution of problems.

There is little doubt that most of the existing lighting problems are self-inflicted wounds resulting from an effort to save money, increase aircraft procurement numbers by accepting the cheaper instruments or the omission of enlightened input for whatever reason.

Sufficient priority must be given to lighting requirements by system and project managers to ensure that they provide for human and operational demands reinforced by dy-

next page

hi **Technical Director, Army Aviation Test Board, Fort Rucker**

- Need a more definitive specification for helicopter ice protection. Statements such as "...provide adequate ice protection . . ." are too broad and place a burden ultimately on both the Army and the contractor.
- A requirement exists to assure that the advanced attack helicopter (AAH) and advanced scout helicopter (ASH) have the same ice protection capability.
- The NASA-Lewis Laboratory has a small low-speed wind tunnel which is ideally suited for helicopter engine icing research. Because of the low-usage factor by NASA, there are considerations toward closing and removing the tunnel. An Army need for this tunnel to conduct research should be verified, and transfer of the tunnel to the Lewis Directorate, U.S. Army Air Mobility Research & Development Laboratory (USAMRDL), should be considered.

The main operational problem is the lack of necessary ice protection for the current inventory of Army helicopters. This protective equipment is not available in the supply system. The following list describes the problem areas by helicopter type:

- The *UH-1 helicopter* has no ice protection except for pitot system heating. The windshield defrost system is inadequate for clearing ice accumulations. Use of windshield wipers results in the ice gouging the surface of the windshield.
- The *OH-58 helicopter* has no ice protection except for pitot system heating. The windshield defrost system is inadequate for clearing ice accumulations. Ice protection equipment, projected for the OH-58 helicopter, must consider the engine power limitations experienced by the user.
- The *AH-1 helicopter* has no ice protection ex-

next page

Porter **Director, Dept of Undergraduate Flight Training, Army Aviation Center, Fort Rucker**

in the annual instrument renewal requirements.

Recommendations are that:

- Deputy for Training, USAAVNC, conduct a study to determine future changes in the programs of instruction for all instrument flying courses taught at USAAVNC. The purpose is to determine where tactical instrument flying should be formally taught, and the amount and nature of such training to include academic training.
- Deputy for Standardization, in concert with Deputy for Training, USAAVNC, conduct a study of ARs 95-1 and 95-63 to determine changes which would require Army aviation worldwide to devote time and attention to tactical instrument flying.
- Use various media to disseminate information to the field about what the Aviation Center is doing in tactical instrument training, and why.
- Deputy for Developments and Deputy for Training at the Aviation Center start to work on the second generation doctrine for tactical instrument flying in a high threat environment. This would be a refinement of procedures now in FM 1-5 considering improved

next page

Lighting

namic acquisition and installation in the operational fleet.

To assure that all available expertise and bona fide expert input are made, it will be necessary to initiate a more positive information exchange and review capability into our materiel development and acquisition processes. It may even be necessary to establish a process of forced coordination. To implement this required coordination it is recommended that as a minimum a standing committee on aircraft lighting, chaired by Deputy for Developments of the USAAVNC, should be convened. This Aircraft Lighting Group would provide a central focus to coordinate through the Commander, Training and Doctrine Command (TRADOC), to Army Materiel Command (AMC) to ensure user-identified lighting problems are being considered and reviewed by medical and lighting experts to assure that adequate solutions are being developed for both fleet and prototype aircraft.

The committee would promote cost-effective programs by preventing redundant research efforts and would provide a central information source and user philosophy for aircraft lighting that would be singular and readily available to military developers and commercial vendors.

This committee also would be available to make recommendations to AMC project managers. To ensure a continued flow of information, project managers should be required to respond formally to specific recommendations of the committee by stating what decisions had been made and actions taken in order to provide necessary feedback.

While it is recognized that this may present an additional burden to the project managers, it is the intent of this recommendation to provide them with the best avail-

Anti-Ice

cept for pitot system heating. The weight penalty for ice protection will be a major consideration in view of the mission weight/power available condition. Ice accumulation on the weapon systems (scopes, mechanism and stores) is a major problem.

- The *CH-47 helicopter* has a heated windshield, pitot system and engine inlet. The ice shed from the blades of one rotor system causes damage to the blades of the other rotor system. Engine inlet foreign object damage (FOD) screens prevent damage to the powerplants caused by shed ice ingestion.

Developmental work is limited and problems associated with this work have not surfaced. The anti-ice/deice work on UTTAS (Utility Tactical Transport Aircraft System), AAH, and the USAMRDL (Lockheed) projects reflect no problems.

It is technically feasible to acquire ice protection equipment for operational use on our current helicopter inventory. On the developmental side, the solutions to our problems are technically feasible. The developmental work should take greater advantage of recent proven technology.

The research and development (R&D) effort should be centered on understanding the problem to a finer degree. Additionally, there is a need for lighter, more effective, cheaper, more reliable and simpler ice protection devices.

Operationally, a PIP (product improvement program) has been submitted by U.S Army Aviation Systems Command (AVSCOM) for the UH-1 helicopter for ice protection. Two ROCs (required operational capability) have been written covering ice protection for windshields on the AH-1R and the AH-1S helicopters. No statements or documents on ice protection for the OH-58 and CH-47 helicopters were noted. Developmentally, ice protection require-

Instrumentation

equipment capabilities.

Another requirement is to discontinue all development and acquisition of the long range navigation (LORAN) and tactical landing system (TLS).

The national microwave system seemingly is the best navigational system feasible for 1976-80. All developmental efforts and funds should be directed toward attaining this system.

A third requirement is to improve and refine materiel requirements for tactical instrumentation.

Materiel requirements documents generally state what we want in tactical instrumentation for 1976-80. However, some are deficient in stating desired *performance data* and characteristics — specifically, what we want this equipment to do for us considering the mission profiles.

There is wide diversification of responsibilities and proponencies for development of navigational and instrumentation systems.

Even though the users participate in drawing up requirements, some of their recommendations and operational requirements are lost or bred-out of the system as it progresses through the various developmental processes.

The multiplicity of tasks required of the pilot could be overwhelming if we neglect to consider interface of the tactical instrumentation system with all of the other systems which will demand his attention in the cockpit, such as fire control and night vision devices.

Rigid adherence to FAA requirements and military standards is in some cases unnecessary and a hin-

able scientific, user and Aviation Center team information to assist them in making enlightened decisions.

The Draft Proposed Required Operational Capability (DPROC), Improved Lighting Systems for Army Aircraft, being processed at TRADOC and Combined Arms Combat Development Activity (CACDA) should receive command support and be approved. Each Army aircraft is proposed to be considered as a separate item as an appendix to the PROC.

The Aircraft Lighting Group should be convened by the Deputy for Developments to implement the DPROC, and the technical characteristics, priorities, and procurement cycle requirements should be defined.

As an interim measure to provide immediate training capability for night operations, it is recommended that specifically identified aircraft be modified in the following ways:

- Install the Night Vision Goggle (NVG) – Compatible Cockpit Illuminator (modified map light).
- Install Emergency Light Switch for immediately returning the cockpit to normal lighting in the event of an NVG failure.
- Put clip-on (removable) filters over the Master Caution, Fire Warning and RPM Warning Lights (add filter check to checklist) *or* put in three-way switch that will place the brightness of these lights at: (1) normal level; (2) the level appropriate for dark-adapted naked eye; and (3) Night Vision Goggles.
- Paint cockpit with black Nextel® Velvet Coating.
- Extend the glare shield.

It was the consensus of the lighting summary group that almost all of the lighting problems can be corrected in the immediate or near timeframe. The only constraints are adequate advice, decisions and available funds.

ments are in specifications for the UTTAS and AAH.

Funding for the developmental work being conducted was not a problem. Since essentially nothing is being done operationally, there is no immediate funding problem. However, looking at representative recurring costs, based on a 500-aircraft quantity, ice protection for the current inventory of helicopters could present a grave funding problem.

Ice protection for field use on the current helicopter is nonexistent. There is no estimate as to when this equipment will be available. At the present rate of progress, the equipment will not be available for use on the current helicopter fleet.

The following suggestions to cope with immediate military needs were made:

- Define precisely the ice protection needs by type.
- Provide selective numbers of helicopters with available anti-ice/deice equipment with mission capability in mind.

Considering the weight penalty, cost and operational effectiveness of anti-ice/deice equipment, these devices should be made available for retrofit on the current helicopter fleet operating in the climatic zones requiring them. As a minimum, on the UH-1 helicopter, ice protection for the windshield, engine inlet and rotor system is recommended.

The minimum ice protection for the OH-58 helicopter is the windshield and engine inlet.

The recommended ice protection for the AH-1 helicopter is the windshield, canopy, engine inlet and weapon system.

Investigation of the incorporation of ice protection for the new improved CH-47 rotor blade is recommended.

Greater emphasis is recommended for programs to advance helicopter anti-ice/deice technology. A new anti-ice/diece design guide for Army helicopters is needed.

drance in designing and developing equipment.

There is little standardization of cockpit arrangement, instrument displays, symbology, and methods of getting information to the pilot. Some instruments may not be essential and could be deleted or replaced by warning lights. Again, the human factor considerations are extremely important in a low-level, low-visibility environment.

It is recommended that a tactical instrument ad hoc working group be formed at USAAVNC, under the aegis of Deputy for Developments to accomplish the following:

- Review and refine all requirements documents, dealing with tactical instrumentation equipment, with particular emphasis on requirements for the new family of aircraft to be expressed in specific performance data.
- Emphasize special problems in terrain flight under low-visibility conditions on the high threat battlefield in a hostile electronic warfare (EW) environment and offer possible solutions to these problems.
- Ensure that tactical instrument equipment and systems of the near future are designed and developed with the needs and problems of the users foremost in mind.
- Prevent overdesign and development of equipment not really needed by the aviator or commander in order to accomplish their missions.
- Determine requirements and make recommendations for standardization of cockpit displays; symbology used for information transfer; and number and type instruments to be used.

FAA Announces 1974 Winners of Aviation Mechanic Safety Awards

An American Airlines maintenance crewchief and the maintenance chief of the nation's largest municipal helicopter operation have been selected as the national winners of the 12th Annual Aviation Mechanic Safety Awards Program.

Winner in the air carrier category is Andrew E. Morgan, maintenance crewchief at American's Maintenance and Engineering Center, Tulsa, OK. John R. Zebora, Chief of Maintenance, Helicopter Division, Los Angeles City Bureau of Transportation, was named winner in the general aviation group.

Sponsored annually by the FAA, Flight Safety Foundation and other aviation groups, the program honors mechanics who have shown outstanding work in advancing aviation safety through maintenance. Mr. Morgan and Mr. Zebora are winners for the year 1974.

Entries for the year 1975 are being accepted by the FAA at the present time. Closing date for entering is 31 December 1975. Army personnel are eligible to enter the contest but they must submit their application before the December deadline.

For details regarding the contest see the *U. S. ARMY AVIATION DIGEST*, June 1975, page 14. Entry forms are FAA Form 1210-1, "Entry Form for Aviation Mechanics Safety Award." These may be obtained from the local FAA office. If you have someone who qualifies, enter him now!

BIG

THERE WAS A TIME when a good many pilots' philosophy could be expressed as "everybody's trying to kill me." Sound paranoid? Perhaps. But a lot of people survived World War Two simply because they believed it, and acted accordingly.

They didn't believe that Pratt & Whitney could find 35,000 additional highly skilled assemblers by placing an ad in the paper. They couldn't accept the idea that their 19-year-old crewchief, fresh off a pig farm in Arkansas, had matured into a combination master mechanic and flight engineer in three months. Or, that the weather briefing officer has been transformed from a bank teller into a first-rate meteorologist in a similar length of time. They were skeptical of everything and everyone, regardless of position, rank or credentials, and they often found that skepticism was justified.

Between then and now aviation has become a highly sophisticated business. Aircraft and hardware have been developed to an undreamed of degree. Freed from the exigencies of war a highly trained body of specialists has taken its place in the aviation field. And most significantly, FAA [Federal Aviation Administration] has developed from a few sleepy individuals tuning communication receivers in radio range stations into a huge authoritarian complex with an air force of its own, a representative in every neighborhood, and a mandate from a nervous air travel-

Mother Can Kill You

Reprint from TWA *LANCET*
Captain Marshall Hydorn (TWA)

ing public to keep pilots on a safe and narrow path from takeoff to landing.

Nowadays pilots engaged in their normal duties of getting a highly vulnerable conveyance from point A to point B interface with a whole body of experts and specialists who not only are qualified by regulation to advise, but many of whom, as FAA representatives, are charged with making sure that advice is adhered to, as in the case of air traffic controllers.

Unfortunately, after just so much coping with "Big Brother," the tendency is to begin to see "Big Brother" as "Big Mother," and eventually to be found sucking at the breasts of the regulatory agency. "Everybody's trying to kill me" is supplanted by "they wouldn't lie to me. They're there to help me." Or, "they wouldn't allow the carriers to operate an unsafe airplane."

The truth is that FAA is just people, and people have a measurable failure rate. Particularly in dealing with controllers, pilots must retain the natural wariness that has proven successful in the past. Skepticism is indicated, even necessary, when on the ground or in the air in the terminal area.

In an increasing number of recent accidents the National Transportation Safety Board [NTSB] has found controllers to be causal factors. Could it be that the real trend developing is an attitude of complacency and a decline of skepticism on the part of pilots?

Recently, a TWA [Trans World Airlines] flight awaiting takeoff observed a near-miss between a light plane and an air carrier aircraft taking off. The TWA plane was then cleared to take off only to have another light plane taxi across the runway in front of it after the takeoff clearance had been issued. An observing FAA controller riding in the cockpit told the crew that the flight plan situation around Denver was in his opinion "out of control" and more than ATC could handle. Two light plane midair collisions have occurred in the Denver area in recent months.

Criticism of control practices is found in the NTSB report of an FH-227B accident at St. Louis: "Through the use of radar incapable of displaying different levels of precipitation echo intensity, controllers vectored several aircraft through a solid squall line which contained severe thunderstorm and tornado activity...in our opinion this was a very dangerous practice because the controller's radarscope display did not indicate whether the line of echoes contained a severe thunderstorm or tornado."

A Boeing 331-C cargo aircraft suffered major damage recently while landing in conditions advertised to be Category I by the tower. The tower neglected to issue a new RVR [runway visual range] to the flight as conditions worsened and RVR fell to 1,800 feet during the approach. As a result, the captain, who had already made it known that he would divert if conditions worsened, was led unknowingly into attempting a landing on a Category I runway, with Category I landing aids in actual Category II conditions. The controller also failed to inform the crew of the fact that an air carrier aircraft, lost on the fog-shrouded taxiway, had actually parked on the high-speed taxiway the TWA flight would most likely have used, just feet short of the runway.

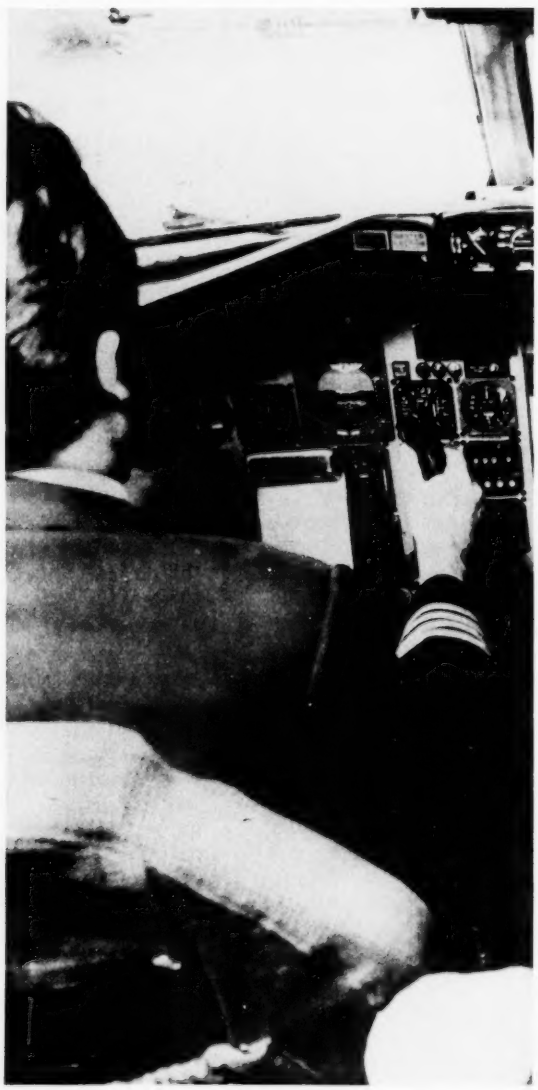
No need to belabor the point, but it's common knowledge that the O'Hare tower was found to share in the responsibility for the collision between a taxiing aircraft and one in the process of taking off from the field.

If you've gotten the idea that this is a diatribe against controllers, forget it. Controllers are a highly trained and able body of men whom pilots respect and admire for their professionalism. The key here is that pilots need to remember that controllers are men. That voice crackling in the headset doesn't issue from some sacrosanct, infallible embodiment of the agency. Controllers, like ILS [instrument landing system] components, are subject to failure—but they don't display warning flags. Like pilots, controllers have marital difficulties, grow older, occasionally forget, can be distracted and are definitely overworked.

And by the way, when you make the list of all those who are "trying to kill you," don't forget to include an occasional dispatcher, the maintenance foreman who thinks his job description includes salesmanship, and last, but not least, the guy in the adjoining seat.

Compared to other modes of transportation, aviation is unique in that it has the lowest tolerance to errors

THE LAST LINE



THE FOLLOWING is excerpted from a presentation at a meeting of an Air Line Pilots Association (ALPA) group in New Orleans earlier this year. Although aimed at air carrier pilots, we feel there's a valuable message here for Army commanders and aviators as well. Views expressed are those of the author and do not necessarily reflect the position of the National Transportation Safety Board (NTSB).

The safety record of air carrier operations presents an apparent inconsistency. Considering the low accident rates of some recent years, one would assume that the few accidents that blemished the record were practically unavoidable. However, an objective observer would have to admit that this assumption is false. Many of these accidents were caused by nothing more than a taking-things-for-granted attitude on the part of various role players in the aviation system. This attitude could easily be a manifestation of overconfidence induced by a relatively good safety record. If this attitude persists, the accident rate will probably fluctuate around its present level, since a better record may aggravate that attitude and thereby neutralize any temporary improvements in the record. I consider this a vicious circle that has to be broken before the potential safety benefits of improvements in hardware and software can be realized.

As pilots, you are at the receiving end of all the technical and attitudinal discrepancies in the aviation system. This implies that you are often the last one who can interrupt the development of an unsatisfactory situation, *if* you are aware of it. The purpose of this article is to stimulate the type of awareness that will counteract any tendency to overestimate the reliability of the system, especially its human elements.

The idea for this approach occurred to me when I read a statement made by keynote speaker Senator Gale McGee during the ALPA honors luncheon in Kansas City last year: "You are a special group

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USAAAVS

OF DEFENSE

that has special problems. You cannot be treated with the same standards of ground-based wage earners." I endorse that viewpoint and I will explain how the special obligations that come with the career pilot's special status are interpreted by somebody who makes a living studying holes in the ground.

What is safety? I could go through an exercise in definitions and you would not know more than you do now. Suffice it to say that the safety bandwagon is a popular one and that many people who jump on it see safety only as the absence of accidents. This explains a fundamental shortcoming in some safety programs: disregard of the fact that the lack of accidents is not necessarily synonymous with safety. You may arrive at your gate without anybody, including yourself, realizing that you had a close call in the last holding pattern. I hope this is not a new thought for you. If it is, you may have used up all the luck you are entitled to because you did not realize how vulnerable the total aviation system really is in its dependence on the proper performance of all its fallible team members. I am not saying this to upset you, but to do away with any illusions you may have about your own invulnerability. If you happen to belong to those who maintain "I won't go before my time" I can only say that even the Great System Designer needs some cooperation on our part to prove His good intentions.

You are probably inclined to believe that we don't have enough knowledge about the role of human behavior in accidents to take effective countermeasures. At least, that is the common rationale for additional research and funding in that area. However, before we have more studies whose main conclusion is that we need more funding for further studies, I suggest that we consider the following fact. During the last 20 years we investigated about 100,000 aircraft accidents. With a few exceptions, the probable cause of all these accidents was estab-

lished. Considering the percentage of identified human errors in these cases we also know that the majority of these accidents could have been prevented by what one writer calls:

- A mildly different behavioral response, or
- A simple anticipation.

I am referring, of course, to the human failures of all contributors to the accident, be they in the tower, the cockpit or elsewhere. Yet, we keep claiming that we don't know enough about the true reasons individuals make critical mechanical or operational errors to remedy the situation. I am inclined to believe that this complaint is based on the frustrations of those who put their faith exclusively in the situational approach to safety which has been so successful in a more easily controlled and stable industrial environment.

In a study of pilot error-related aircraft accidents the authors came to the conclusion: "To place the blame on the pilot does little to prevent others from committing the same error unless *design* changes are instituted, *procedures* modified or *training* programs altered to eliminate that type of human error." [Emphasis added] Although training does affect behavior, it does not necessarily compensate for variations in performance caused by certain frames of mind.

When we limit our interest to after-the-fact analysis of defective behavior that can be offset by a design or regulatory solution, we face an alarming question: If we did not learn enough from the last 100,000 accidents, how many more do we need to satisfy our utopian notion that, once we know enough about the peculiarities of human behavior, we can design or regulate around it?

Although I have the highest regard for the engineering skills in the aerospace industry, I believe there are compelling reasons, economic and otherwise, why we cannot afford to apply literally the following concept: "There can be no reliance on the margin of human error in matters of air safety. Safety must be assured through foolproof design" (subcommittee report entitled "Air Safety, Selected Review of FAA Performance," House of Representatives, 1974). This concept could not even be applied to the liberally-funded Apollo program with its highly controlled and motivated work force. Attitude and motivation are an important part of the NASA system safety program.

In addition to the influence and carryover of industrial safety concepts there is another factor that explains our preference for (or is it overconfidence in?) design solutions for aviation safety problems.

The futility of appeals like "Safety First" is now apparent even to the practitioners of institutionalized safety. It is probably correct to say that there is no realism in safety programs that base their entire appeal and justification on the premise that "a powerful urge to prolong life as long as possible, without disability, motivates individual concern about safety."

Most of the safety progress in air carrier operations during the last 20 years can be directly attributed to improvements in technical and other tangible areas, including human engineering, redundancy, training, procedures and regulations. However, there are already warnings that the indiscriminate application of technology in the prevention of human error may create other error potentials. C. Stout, in a Flight Safety Foundation publication, said: "Many prominent people in our industry are of the opinion that flight crew complacency has been increased at a pace equivalent to the advances in the technology that has been applied in the design and manufacture of the latest generation of jet transports." H.A. Hopkins, summarizing a safety symposium, stated: "It would be very counterproductive to safety if we attempted too much to reduce crew fallibility by introducing complexity, if in turn it led to an increased complexity in the maintenance area." This could lead to a situation where we trade off crew fallibility for maintenance error.

Rather than favoring the exonerative view that

fate is always the hunter, especially in accidents where the crew's contribution was triggered by discrepancies that can be blamed on those who don't share the crew's risks, you should look at accidents and incidents as reminders for honest self-appraisal. Rank, age and experience don't make anybody immune to error. As one pilot put it: "Even with the best of warning systems and the best will in the world, occasionally a pilot will do a stupid thing."

You should be able to accept without bitterness the NTSB's statement: "Investigations have revealed that crew behavior ranges from the casual acceptance of the flight environment to flagrant disregard for prescribed procedures and safe operating practices."

From the behavioral viewpoint, thorough aircraft accident investigations and reports contribute to safety in two important ways: (1) They create performance awareness by emphasizing the preferred and expected behavioral responses, on everybody's part, that could have prevented the accident *under the then existing circumstances,* and (2) they produce recommendations that modify, insofar as feasible, the existing circumstances so that deficient behavior becomes less likely, or less critical, in the future.

Instead of taxing your patience with an endless summary of the safety lessons from past accidents as they affect you as pilots, I will try to put the implied meaning of all these lessons in a single message: You are the last line of defense in a system operated by individuals susceptible to error. To the extent that the system needs, and has, a built-in tolerance to the unreliability of its hardware, software and liveware elements, most of it has to come from you and your crew. It is exactly this interpretation of professional responsibility that makes you a special group and entitles you to special remuneration. You would demean your profession by letting anybody tamper with that interpretation.

Is it reasonable to assume that belonging to a special group also means that more can be expected from you as far as behavioral standards are concerned?

As you should realize by now, my answer is an unqualified "yes." Selection, training and peer group standards rob you of the privilege to use common excuses for less than professional behavior. This applies even when you're dealing with known shortcomings in the system.

The millennium in aviation is not here yet. In the meantime, you have to work with what you've got and you should not let the irritatingly slow progress in some areas affect the manner in which you deal with less than satisfactory situations. I am not saying that you should accept, without protest, system discrepancies that are beyond your control. Since you are a pilot audience, I can only suggest how to take care of yourself while pressing and waiting for improvements.

To be effective as the last line of defense you need what one of the characters in John Le Carre's latest spy novel calls "an infinite capacity for suspicion." To adjust this advice to the more orderly world of aviation I will change it to *an infinite capacity to be wary.* Wary is defined in Webster as "prudently attentive to the dangers one may encounter or the risks one may face." You would not be here now if you had not developed the ability to be mistrustful to some degree. This is the pilot's principal survival tool in an environment where failure to foresee the consequences of a minor compromise, a false assumption or a marginal situation may lead him astray. The same wariness should also induce you to maintain your knowledge of the equipment you operate. You don't want to contribute to a situation that J.A.M. Meerloo calls an "excess of technology in the hands of inadequate minds."

I have shown that you belong indeed to a special group, but mainly because more can be expected from you. Finally, I have stressed your role as the last line of defense in a system that cannot be made perfect by technology alone. To a large extent, the reliability of the system is governed by your attitude. The attitude you need I can best convey as follows:

For the price of a ticket, anybody can share your fate. For the brief occasion of the flight you are the trusted link between the people sitting behind you and those who are waiting for them. Only an infinite capacity to be wary of yourself, your crew and all the other elements in the system will justify that trust.

USAAAVS

SEE and BEE SEEN

THE TIME—1330 hours, 21 May 1903. The place—farmer Jones' clover field, Honey Haven, Kentucky. Delvin Detrick, a young bee who was flying for Drones, Inc., was returning to the hive from a routine reconnaissance and resupply mission in the local area. He had been dispatched to observe reported activity in Mrs. Jones' garden. Delvin maneuvered into position for a straight-in approach, approximately 100 feet southeast of Honey Haven Regional. He completed the before-landing check and adjusted power for approach speed, but realized he was too close for landing behind a company drone directly ahead and low. He started a left climbing 360-degree turn for spacing when the collision occurred.

Delvin continued flight and landed without further incident. The bumblebee he had struck crashed and burned. Investigation after landing revealed that Delvin had suffered major damage to all structural components. He had lost a substantial amount of his right skid, chin bubbles were broken, right cargo door was missing, tail boom buckled and tail stinger fractured.

Intentions of the bumblebee are still unknown but he had been seen earlier performing aerobatics and had made a pass at the queen.

The accident investigation was conducted by the Nectar Through Safe Bees (NTSB). Their report showed that:

- The sky was clear and visibility unrestricted.
- Both bees were certificated and qualified to conduct the flight.
- Both were maintained in accordance with existing regulations and company procedures.
- There were no obstructions to vision.

The NTSB determined that the probable cause of

Major Leon D. Wikle
South Dakota Army National Guard

the accident was a violation of one of the most basic principles of good operating practices, "alertness."

There's a lesson to be learned by aviators from these experts in the field. Be especially alert when the skies are clear and the visibility good. Most midair collisions occur during ideal weather conditions. Unlimited visibility encourages a false sense of security. When on a VFR flight plan, conform to VFR cruising altitudes. When climbing and descending, move to the right side of airways and be on the lookout.

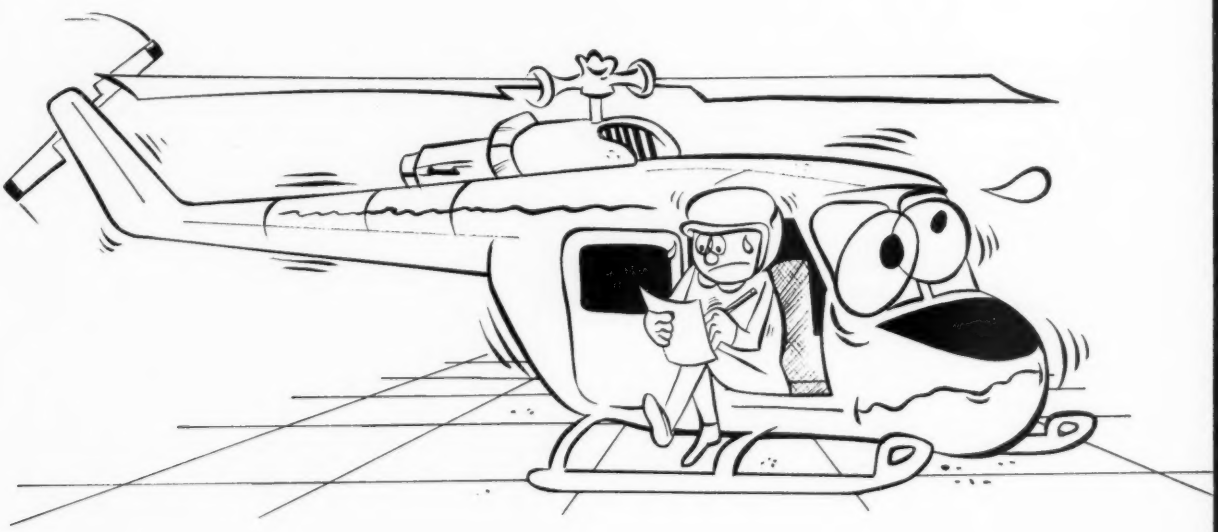
Federal Air Regulations 91.89, Operations at Airports Without Control Towers:

- In the case of an airplane approaching to land, make all turns of that airplane to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right, in which case the pilot shall make all turns to the right.
- In the case of a helicopter approaching to land, avoid the flow of fixed wing aircraft.
- In the case of an aircraft departing the airport, comply with any FAA traffic pattern for that airport.

Know the regulations, use good operating practices and be alert.

A note from the queen bee. I wish to express my appreciation to the NTSB and all other drones that participated in the research and investigation of this accident. It has been proven through extensive flight testing that it is impossible for two bees to fly through the same point in space at the same time, regardless of their direction of flight. A near miss is the more acceptable method. However, there is a fine line between a near miss and disaster, and your honey-hauling days are over.

OHR - PASSPORT TO SAFETY



ARMY AVIATION is currently enjoying one of the best safety records in its history. During the period July 1974 through June 1975 Army pilots were involved in only 6.4 accidents per 100,000 hours of flight—a good reason to be jubilant. But let's pause for a moment and take a closer look at what these statistics are really telling us. As we celebrate our lowest accident rate in years, we are, in effect, saying we are happy we crashed *only* 98 aircraft instead of more; that we needlessly wasted *only* $16.1 million for damaged and destroyed equipment instead of more; that we injured *only* 101 aircraft occupants instead of more; that we killed *only* 26 personnel instead of more. . . . Suddenly, we seem to have lost some of our zeal for celebrating.

The road to improvement, it would seem, would be to concentrate our efforts in additional areas of safety. We might, for example, establish some means of ensuring new aircraft under development are free from design deficiencies that plagued their predecessors. We might design better seats and restraint systems for improved protection to occupants in the event of an accident, and we might engineer more efficient egress systems to permit safe and timely evacuation should such need arise. Further, we might establish an effective Army aviation safety program along with a companion standardization program. . . . The fact is we are actively engaged in all these projects—and many more. Yet, we continue to have accidents.

For the solution, we must turn to ourselves. As the U.S. Army Agency for Aviation Safety (USAAAVS) has often stated, all the "easy" efforts that can effect drastic improvement in safety have already been applied. We are going to have to let this truth sink in, and realize we must be prepared to fight a rugged uphill battle if we are to obtain further improvement in this all-important area. And this is where *you* enter the picture. Any meaningful additional gains in safety are now dependent upon the actions of the individual and how he accepts his responsibilities.

Ted Kontos
Publications and Graphics Division
USAAAVS *U. S. Army Agency for Aviation Safety*

The Operational Hazard Report is designed to be a rapid method of bringing hazards to the attention of those who can, and will, take corrective action to eliminate them

How well a pilot plans each mission; how thoroughly he performs his preflight inspections; his use of cockpit checklists; his adherence to regulations and SOPs; how closely a mechanic follows by-the-book procedures when he performs maintenance and inspections—these are but a few of the types of individual actions that can make or break any safety program. But of all the safety tools available to aviation personnel, one of the most effective ones has barely been touched. It bears the unglamorous designation of DA Form 2696 and is better known as the Operational Hazard Report (OHR).

The OHR is designed to be a rapid method of bringing existing hazards not previously recognized to the attention of those who can, and will, take corrective action to eliminate them. AR 95-1 provides instructions for use of this form in accordance with AR 95-5 which gives examples of the types of operational hazards to be reported. The advantages of the OHR program are numerous and varied. First of all, it is the only program in the field of aviation safety that places every person associated with Army aviation in the "driver's" seat, regardless of duty assignment or rank. Each becomes, in part, his own safety officer with full authority and freedom to put his point across to the commander and to those who can take necessary corrective action. In effect, he becomes a part of management and his sphere of influence, no matter how small, brings others into the program. When everyone associated with Army aviation actively participates in the OHR program, we are automatically provided with as many safety officers as we have personnel, and the beneficial effects on safety become far more significant than could otherwise be possible. The OHR program is one of the greatest deterrents to accidents presently available.

When you prepare an OHR and submit it to airfield operations or to the airfield safety officer, the following actions are typical of those that generally follow:

- The local aviation safety officer will thoroughly investigate the circumstances reported and submit the report along with his findings and recommendations to the commander responsible for taking corrective action.
- If the problem cannot be corrected at unit level the next higher command in the chain will be informed of the matter. This procedure will continue until the job gets done.
- While a signature on the OHR is not required, if you have included yours along with your address, the commander responsible for taking corrective action is required to notify you, within 15 working days, of the action taken or planned.
- Major Army commands will forward reports that require corrective action beyond command capabilities, reports that involve FAA personnel or facilities, and reports that have worldwide application to the Commander, U.S Army Agency for Aviation Safety, Ft. Rucker, AL 36362.

Keep in mind the OHR program is not limited to Army aviation. Our sister services have similar programs in which you are invited to participate. Similarly, you are encouraged to participate in the FAA aviation safety reporting program (see DA message DTG 2720052 Jun 75 and *Flightfax,* 2 July 1975).

A word of warning concerning OHRs is in order. The degree safety can be enhanced by proper use of these reporting forms depends on two factors: active participation of aviation personnel in the program and prompt response to reports received by commanders and those responsible for taking corrective action. A case in point dates back more than 15 years, but it clearly shows the results that can be expected when either of these factors is neglected. The safety officer assigned to a flight training installation was extremely conscientious in accomplishing his duties and placed a lot of faith in the use of OHRs. So much so, he prepared and maintained a wall chart on which he listed all reported hazards by type and frequency of report.

Shortly after assignment of a new commander, changes were made in some areas of flight operation. One of these was the authorization to mix traffic and permit straight-in approaches in a rectangular pattern. Soon after the policy change, the safety officer began to receive OHRs of near misses. All

instances had occurred over the same general area. His immediate action was to warn all instructor and student pilots of the danger while the commander evaluated the reports before determining a permanent fix. Meanwhile, the safety officer became alarmed at the increased number of reports concerning near misses over the same general locale, and promptly brought the matter to the commander's attention, pinpointing both the problem and the danger zone. Before any corrective action was taken, a midair collision occurred almost over the exact spot predicted by the safety officer, causing the loss of two lives and the destruction of both aircraft.

Another case, involving a different flight training installation, points to the type of problem that can result from failure of personnel to participate in the OHR program. The first indication was a midair collision over a particular location within the training area. Investigation revealed the cause which was promptly corrected. However, shortly afterwards another midair collision occurred over a different portion of the training area. Again the cause was determined and a cure effected. Two more collisions similar to the previous ones followed, and each took place over a different area. In each instance, investigation revealed the problem for correction. All in all, four catastrophic accidents occurred over a 6-month period at a cost of eight lives. Yet, it was later discovered that in each of the flight areas involved, near misses had been occurring frequently but none had been reported. Obviously, either delays in taking corrective action or failure to report known hazards can render any OHR program useless.

In contrast to these examples, safety personnel at one flight training facility were kept busy reviewing the myriad of OHRs submitted and investigating the circumstances reported. As a result, problem areas were identified and timely cures developed and implemented. This installation was annually presented safety awards and remained accident-free during more than 2 years of full-time operation. Without a doubt, an active OHR program effectively managed can spell the difference between success and failure.

The DA Form 2696 is an AG form and must be requisitioned for initial distribution as well as replenishment as needed. Presently, Army personnel are submitting OHRs at the rate of 6,000 to 8,000 each month on a worldwide basis. Use of this form can be one of the best means of preventing accidents available to us. In fact, the OHR can literally become a passport to safety—yours as well as that of others. Use it.

BAD VIBRATIONS

ONE OF THE BEST mishap prevention tools remains the lessons learned from personal experience—preferrably someone else's. The following account of a near-accident, told by the crew of a UH-1, provides a "crash" course in the effects of wake turbulence.

PILOT: I took off on a night VFR flight to another airfield where I did a GCA and was cleared to climb to 2,500 feet direct to destination. It was a beautiful clear night with 20+ visibility. After initiating a climb, I asked the copilot if he wanted to fly for awhile. He took the controls and climbed to 2,500 feet and asked me to tune in destination VOR, which I did, and set the OBS

...s for a centered needle. Less than a minute after my aircraft shook violently, ...ng up with a slight roll to the left, ... right and rolled to the right with ... pitching down sharply. I frantically ... the cyclic. It was in the full right, slightly forward position. While trying to hold on and push the cyclic left I could see car lights on the highway below through the greenhouse. The aircraft was still shaking violently and was falling, giving the same sensation as a roller coaster when it starts its descent.

I feel the aircraft was 90 degrees or more in a right bank before the cyclic came to the full left position. I don't know if the copilot and I together pulled it to the left or if it pulled us to the left. My first thought was that we had lost the main rotor and were falling to the ground. This lasted only 1 to 4 seconds before the aircraft was righted and smoothed out. A mayday call was made during this time. When I saw that the copilot had it under control and had lowered the collective I released the cyclic and began searching for the best possible landing area. He asked me to check the engine instruments and they were all normal at that time. The copilot was talking to the radar controller all the way down, telling him where we were and what we were doing.

The landing was made in a hay field with no ground run and all systems seemed to be functioning normally at that time.

COPILOT: I was on the controls at the time and we were flying straight and level at 2,500 feet msl. All instruments were normal. Suddenly the nose pitched up about 30 degrees and to the left. It felt like we hit a brick wall. The aircraft began a violent and shuddering roll to the right. I saw a large cluster of caution lights and the master caution came on. It seemed we rolled past 90 degrees. At this point the pilot and I were both on the cyclic trying to bring the aircraft back level. After we recovered to a level attitude I initiated autorotation, got out my mayday call and talked to approach control all the way down.

PASSENGER: The aircraft jerked suddenly and nosed up almost perpendicular to the ground. I noticed the pilot's cyclic stick jumped forward and slightly to the right and it appeared to have thrown the pilot forward, causing him to lose control. The aircraft then rolled slightly to the left and then rolled extremely to the right at least 90 degrees and I thought we were going all the way over when the copilot said "I've got it" and a few seconds later the aircraft leveled off and I noticed we had lost considerable altitude and airspeed.

During all of this I saw all of the inside forward panel lights flash off and on several times. Also, the aircraft was shaking violently as if it were going to shake itself apart.

After we leveled off we circled down as the copilot talked to the tower and we landed in a hayfield.

* * *

The maneuvers were so severe that they caused the inertia reel on the copilot's side to stick and one leg of the bench seat in the back was disconnected from its socket.

There were two possibilities as to the cause of the violent maneuvers, either a malfunction of the hydraulics system or turbulence. The nature of the maneuvers was not that commonly associated with a hydraulics malfunction and inspection of servos and hydraulic system showed no sign of a hardover or any other malfunction.

Based on the reaction of the aircraft and crew statements it was determined that turbulence was the only plausible explantion. The only known source of turbulence in the area was a B-52 which departed the airfield several minutes before the incident occurred.

There was only one other known aircraft in the vicinity and it was a light Cessna 1,000 feet below their altitude. There are several low level, high speed training routes in the area but they are approximately 25 miles north of the airport and not considered a factor.

Weather-induced turbulence seems unlikely since the weather in the area at the time showed no turbulence-producing conditions and there were no surface or high altitude winds.

Although no absolute cause was established for this incident, wake turbulence was the most likely explanation and the B-52 was probably the culprit. An article entitled "Vortex Wake Turbulence" which appeared in the February 1975 *AVIATION DIGEST* states, "Natural atmospheric turbulence can shorten breakup time of wake turbulence, but even then a choppy condition can remain in the area for some time." At the time of the incident, winds were calm and very little natural atmospheric turbulence was present to break up the vortices.

USAAAVS

Brigadier General John G. Hill Jr., III Corps and Fort Hood chief of staff (left), presents Broken Wing Awards to CW2 Darrell M. Wiebesick (center) and CW2 Willard G. Rusk. Mr. Rusk and Mr. Wiebesick were serving as pilots in a firefighting and crash rescue demonstration when a fire suppression tank sprang a leak and filled the UH-1H with a sudsy-like foam while they were on approach to the fire area from 200 feet agl. This foam caused both pilots to lose all visual reference to the aircraft instruments and outside the cockpit. As Mr. Wiebesick continued to fly the aircraft, Mr. Rusk opened the door to obtain outside visual reference. Through outstanding teamwork, Mr. Wiebesick safely landed the aircraft while Mr. Rusk served as his eyes.

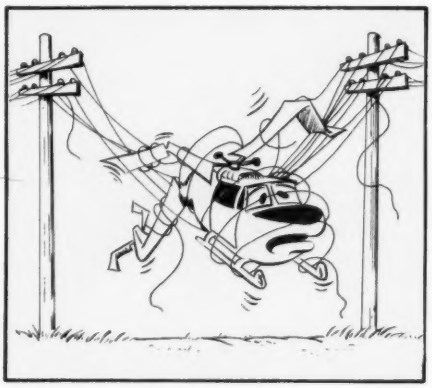
CW3 Tommy H. Martin, pilot, and Captain Wayne S. Fischer, copilot, received Broken Wing Awards for

BROKEN WING AWARDS

landing their CH-47A without damage during an emergency. While en route from Ft. Wainwright to Anchorage, AK, at 1,150 feet agl, a fuel transfer was made from the internally mounted to the main fuel tanks. Immediately the No. 1 engine N1 indicator fluctuated and could not be stabilized with the beep control. A left turn was made to return to Ft. Wainwright. While leveling off from the turn, Mr. Martin moved the No. 1 engine condition lever to the ground position and the No. 2 engine flamed out simultaneously. As a result of dual engine failure, both generators were lost which created a complete electrical failure and a decay of rotor rpm to 172. While Mr. Martin controlled the aircraft, CPT Fischer monitored the instruments and gauges and made mayday calls. Mr. Martin lowered the nose to regain airspeed and rotor rpm to clear a tree line and to reach a suitable landing area. He autorotated with no lights to an oval-shaped area covered with 4 feet of powdered snow and surrounded by 50-foot trees. This is a tribute to the professionalism of both aviators, considering that the landing was made from a low altitude and in blowing snow.

Second Lieutenant Roy A. Lockwood was on a UH-1H training mission in the vicinity of St. Louis, MO. He was flying at 2,000 feet msl and 80 knots over a residential area when the tail rotor separated from the aircraft, causing structural damage to the tail boom, 90-degree gearbox and tail rotor drive shaft. LT Lockwood increased power to fly to a nearby airfield, but the aircraft assumed a nose-low attitude and spun to the right. He was able to stabilize the aircraft with full down collective, with the nose 45 degrees downward, with a 45-degree nose right yaw to the flight path, and with airspeed between 80 to 100 knots. Although unable to turn left, LT Lockwood maintained a flight path of about 300 degrees toward a suitable landing area. He added power to reach the area and cleared some powerlines by only 10 feet. At 50 feet, he lowered collective, rolled the throttle off and started to decelerate. On reaching 10 feet and with airspeed less than 5 knots, LT Lockwood increased collective to cushion the landing and the aircraft began rotating rapidly to the right. Holding the aircraft level, he lowered collective at 2 feet and safely landed (photo below).

briefs that teach



wire woes

The pilot and copilot assigned the lead aircraft in a flight of four UH-1s were to fly a tactical training mission in conjunction with the troop's field training exercise. A final briefing covering the mission, route of flight and safety hazards was given before departure. The lead aircraft had a crew of four and six passengers.

The flight descended to a low altitude as they entered a predesignated area and started flying nap-of-the-earth. Flying over an open, relatively flat field at an altitude of approximately 10 to 15 feet and at a speed of about 25 knots, the pilot of the lead aircraft saw a pole to the left front and then the wires. **He immediately yelled "wires," pulled pitch and flared the aircraft. The copilot, who had been navigating, looked up just in time to see the wires hit the windshield.** The aircraft crashed and one crewmember and two passengers sustained minor injuries.

The wires, not readily visible, were not spotted during the route reconnaissance the previous day. This was due to crew inexperience in NOE reconnaissance techniques.

Flight hazards were not marked on the map used by the crew of the lead aircraft and the unit SOP did not cover this subject.

fascinating combination

Maintenance personnel adjusted the pitch change links on a UH-1H to correct a high rotor rpm noted during practice autorotations the previous day. The pilot/platoon maintenance officer was going to perform a limited test flight to check the proper operation of the main rotor rpm. The platoon IP suggested that he go with the pilot to perform touchdown autorotation training following the test phase of the flight.

After takeoff, an autorotation was initiated to check the actual rotor rpm. The rotor stabilized within the green range at 324 rpm and the IP decided to continue the autorotation to touchdown. Witnesses said the aircraft appeared to be in a nose-high attitude of approximately 30 to 45 degrees from the horizon from an altitude of about 200 feet all the way to the ground. The IP noted the airspeed to be 65 knots at approximately 180 feet agl and told the pilot to lower the nose to gain airspeed. The pilot lowered the nose momentarily and noticed an increase in rate of descent but no appreciable increase in airspeed. He then returned to a deceleration attitude as the aircraft neared the ground. Witnesses said the nose of the aircraft never fell below the horizon before its return to deceleration attitude and it appeared that no attempt was made to level the aircraft.

The tail stinger struck the ground first, followed by both tail rotor blades. The left skid then hit the ground and the aircraft came to rest on its left side. There was no fire and the crew received minor injuries.

The pilot and IP became fascinated with the main rotor rpm instrument during the initial phase of a practice autorotation and lost proper perspective of the attitude, airspeed and rate of descent of the aircraft in relation to the ground. The IP, due to his instruction and fixation with the rpm indicator, failed to recognize the abnormal situation and did not initiate corrective action. This error can be attributed to combining a maintenance test flight with a maneuver as complex as a practice touchdown autorotation.

scary business

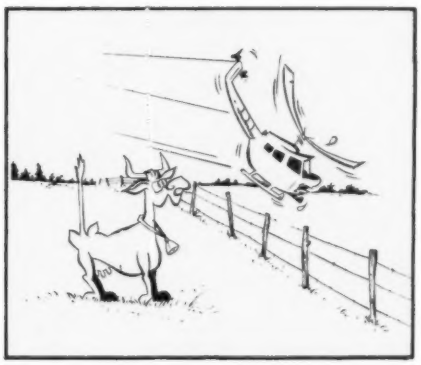
A flight of four UH-1H helicopters was scheduled to depart home base at 0800 hours, with two refueling stops en route. The flight would remain overnight at the third stop and proceed to destination the next day.

Arriving at their first fuel stop at about 1010 hours, the pilot of one aircraft learned that he was to return to home base because of a potential red X condition on his aircraft. He was told that a hydraulic oil sample indicated a high aluminum content.

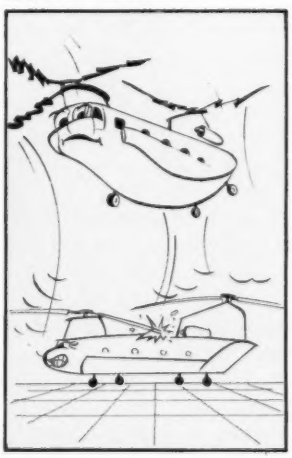
The crew arrived back at home base about 1300 hours. The hydraulic system was drained and flushed and while the aircraft was being test flown the pilot requested and was granted permission to go ahead with the first leg of the ferry flight at night. The aircraft departed again around 1720 hours.

Approximately 1 hour after takeoff the engine failed. During the descent, the crew noticed a barbed wire fence at the intended point of landing. The pilot caused the aircraft to impact hard by extending his autorotational glide. However, this was the best course of action in view of the fact that the barbed wire fence was discovered only at the last minute.

The scary thing about this mishap is that the crew flew the aircraft back to home base with a known red X condition and the pilot–after being awake and flying for the previous 13 hours–actively sought to fly at night on a ferry mission and permission was granted.

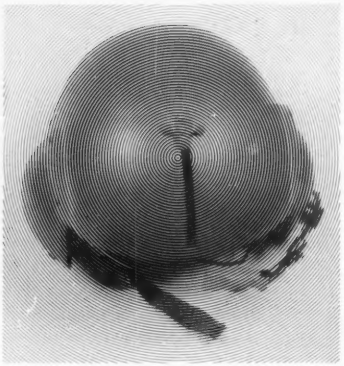


hover sense

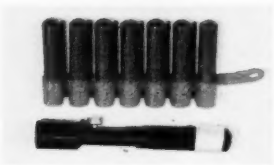


A mission involving two CH-47 aircraft in support of an airmobile training exercise was scheduled and included an on-site practice session the day before the actual mission.

During the final phase of the practice exercise the aircraft were tasked with sling loading two 105mm howitzers. The first aircraft returned carrying one howitzer which was unloaded at the north end of the runway, and the pilot parked the Chinook at the northwest corner of the airfield. The shutdown procedure had been completed when the second aircraft arrived with the other howitzer. The pilot made a downwind approach from the south, terminating in the vicinity of the first aircraft. **Then he proceeded to hover within 75 feet of the slowly turning rotor blades of the parked aircraft. At this point rotorwash forced a rear blade of the parked aircraft to flex down and strike the left side of the fuselage. Damage was estimated at more than $56,000.**



USAAAVS



USAAAVS **Patsy Thompson**
Publications and Graphics Division
U. S. Army Agency for Aviation Safety

EIR-LSE

WHAT'S THE FIRST thing that comes to mind when an Equipment Improvement Recommendation (EIR) is mentioned? No doubt, the majority of individuals would say that EIRs are submitted on deficiencies affecting aircraft systems or components. If this is your thinking, you are only partially right, because another very important aspect is your personal survival and protective equipment.

Since the beginning of Army aviation, we've come a long way in providing better and safer personal survival and protective equipment, but as the old saying goes, "There's always room for improvement." And the best source of information for improving this equipment is recommendations submitted by you—the daily user.

Let's review a few improvements in survival and personal equipment which resulted from EIRs submitted from the field.

- The gauntlets on the flyer's summer gloves were made 1 inch longer to prevent separation between the gloves and the sleeves of the flight suit, providing better thermal protection. The new gloves, GS/FRP-2, are sewn with a nonmelting filament Nomex thread and the thumb seam is doublestitched to help prevent seam separation. In addition, special processing has made the leather perspiration resistant and, therefore, more durable.
- A blue translucent filter was placed in one end of the SDU-5/E distress light marker, a component of the SRU-21/P individual survival vest. This improvement filtered out the white light, preventing the marker from being identified from altitude as automatic rifle fire.
- The present-day helmet bag is much larger and contains two compartments for carrying flight publications, a great improvement over the old bowling-ball-type bag.
- The flyer's nylon jacket was reclassified as

ARMY AVIATION LIFE SUPPORT SYSTEM EQUIPMENT

FLIGHT HELMETS
Visors and Lenses
Sound Attenuating Devices
Ear Pads
Communications Equipment

FLIGHT CLOTHING
Footwear
Gloves
Antiexposure Suits
Fire Retardant Flight Suits

RESTRAINING DEVICES/EQUIPMENT
Torso Harnesses
Seat/Lap Belts
Leg Restraint Systems
Aircraft Seats/Cushions
Gunner Harnesses
Shoulder Harnesses
Inertia Reels for Aircraft
Harness Releases

FLIGHT HYPOXIA WARNING DEVICES

SURVIVAL EQUIPMENT/KITS/VESTS
Kits w/components
Vests w/components

EJECTION SEATS/ESCAPE DEVICES
Rocket Catapults
Seat Stabilizers
Parachute Spreaders
Propellent Activation Devices
Recovery Parachutes
In-Flight Escape Equipment

SURVIVAL AVIONICS
Survival Radios
Search and Rescue Beacons
Emergency Locator Devices
Energy Sources

FLOTATION DEVICES
Liferafts
Life Preservers

AIRCREW BODY ARMOR

OXYGEN SYSTEMS/COMPONENTS
Gaseous
Candle Generators
Liquid
In-Flight Equipment
Walk-Around Types
On-Board Generating System

LOWERING AND RESCUE DEVICES

EGRESS AND ESCAPE DEVICES

PROTECTIVE MASKS
Oxygen
CBR
Smoke

EMERGENCY PERSONNEL PARACHUTES

FLIGHT GOGGLES AND SUNGLASSES

AIRCREW HEARING PROTECTORS

Standard LCC B and replaced by the new Standard LCC A Nomex flyer's jacket which is flame resistant and antistatic treated. This new jacket is also more comfortable and acceptable in appearance.

• The cotton flight uniform (K-2B) was deleted from the Army inventory and replaced by the Nomex flight uniform. The shirt sleeves have been lengthened for better protection and the pockets have been angled for easier access. The buttons on the Nomex trousers have been replaced by velcro tabs and the fly zipper by buttons. The introduction of this uniform has reduced thermal injuries of aviation crewmembers during postcrash fires.

Now under consideration are EIRs on the cold weather flying jacket and the repacking of the one-man life raft.

The hood on the cold weather jacket bunches behind the neck and presses against the flight helmet, making it difficult to hold the head erect. Also, the hood interferes with the shoulder harness. The large buttons on the jacket are difficult to manipulate without removing the mittens, which increases exposure to cold injury. The suggested fix is to split the hood and install zippers to prevent the hood from bunching and to replace the buttons with velcro fasteners.

Repacking of the one-man life raft into a smaller, more compact area would allow it to be worn by an individual so that it would be more readily accessible in the event of an emergency.

While EIRs are being submitted by accident investigation boards on life support equipment which in any way was implicated in the cause of injury during a mishap, EIRs should be submitted on equipment hazards before-the-fact to prevent needless injuries or fatalities. Also, USAAAVS recommends EIRs be submitted on life support equipment which does not provide adequate protection, perform as designed or fulfill your needs, or which hamper the user when performing his duties.

If only one or two EIRs on an item are submitted during a year, they will probably be scratched off as an isolated case. However, six or eight EIRs on the same item will gain attention and the problem will be considered for a cure. So the greater the number of EIRs submitted on a particular item, the greater the apparent need for an improvement.

If you know of a condition or materiel fault that is a hazard to personnel, equipment and mission accomplishment, you should submit an EIR on DA Forms 2407 and 2407-1 in accordance with paragraph 3-16, TM 38-750, dated November 1972. The recommendation should also be considered for submission as a suggestion under the provisions of AR 672-20, "Incentive Awards."

Although not required by regulation, USAAAVS would like an information copy of EIRs pertaining to aviation life support equipment. Not only will this let us know of the EIRs and facilitate compilation of EIR history on aviation life support equipment, but it will improve EIR followup actions. The time required for acceptance, recommendation for adoption and approval may require 6 months or longer. In the event a response is not received from the responsible agency within a reasonable timeframe, USAAAVS will initiate a followup on an EIR upon request.

If you have a question about
personal equipment or
rescue/survival gear, write Pearl,
USAAAVS, Ft. Rucker, AL 36362
USAAAVS

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

Captain Harvey D. Bien

Mother Nature can create an environment as hostile to unprepared aviators as any fabricated by hostile forces

A TIME TO LIVE

CPT BIEN IS assigned to the 4th Aviation Company, 4th Infantry Division (M), Ft. Carson, CO. He prepared this article while attending the Aviation Accident Prevention Course at USAAAVS.

Survival equipment? Why wear it! Everyone knows aircraft crashes are preventable, and those that do occur usually take place near populated areas where help is readily available. The reasons given to justify not wearing survival equipment are greatly varied. For instance, survival vests are bulky and sometimes uncomfortable. We are no longer flying in combat zones. Survival equipment is expensive, it's often not available through supply channels or it's not issued except as needed.

But the truth of the matter is that any flight where survival equipment is not carried is potentially disastrous and training flights are no exception. Students must be given the same opportunity to survive as operational pilots. The period after the accident and before rescue is no time to realize that important survival equipment has been left in the company area.

My first experience with actual survival began when our aircraft was forced down approximately 45 miles east of Colorado Springs, CO. I was on board as an observer. We were not able to contact any controlling facility before the forced landing, and we could not locate a farmhouse to confirm our safety for 3 hours. When we finally made contact at 2 a.m., we were told by our platoon commander that we would be picked up early that morning. However, at 4:30 a.m. a low front moved through the area, snow began to fall and we sought additional shelter. Initially, we had stayed beside the aircraft and built a small fire on the road away from the aircraft.

Assistance finally arrived at 2 p.m. the afternoon after the forced landing. Between 11 p.m. one day and 2 p.m. the next, the daytime temperature had dropped to 22 degrees F., approximately 6 inches of snow had fallen, and winds were reported to be 45 knots gusting to 60 knots. Had there been no shelter, all three of us would have been seriously injured because of exposure.

Survival is critical. There is no guarantee that assistance will be readily available, so those involved must have the resources to sustain life until help arrives. Aviation personnel must be issued appropriate equipment for survival, and they must use this equipment as religiously as Nomex and helmets. Mother Nature can create an environment as hostile to unprepared aviators as any fabricated by hostile forces.

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

Revised AR 95-50

MOA (Military Operations Area)

A REVISED AR 95-50, Airspace and Terminal Instrument Procedures, will be forthcoming shortly. It contains extensive changes in policy, procedures and management responsibilities. Included in the regulation are terminal instrument procedures extracted from AR 95-9.

This regulation pertains to Army commands and installations worldwide, and to Army National Guard and Army Reserve Units having responsibility or interest in airspace matters, airfield operations, navigation facilities, or are involved in construction of any type that will protrude into navigable airspace.

The general policy statement has been revised as follows: "Airspace has become a critical national resource. Increasing numbers of users are placing greater demands on existing airspace which has resulted in more controls. Therefore, it is Army policy that airspace requirements be minimized to the extent possible and that commanders carefully scrutinize each additional proposal to ensure that the proposed activity cannot be contained in existing Army or non-Army airspace areas. In addition, Army using or controlling agencies will, when feasible and when such action will not detract from the agency capability to perform its mission, permit joint or shared use of their designated airspace areas. Further, all commanders having designated airspace will review, at least once annually, and modify or eliminate these areas as requirements change or no longer exist."

Procedures contained in FAA (Federal Aviation Administration) Handbooks have been extracted and reprinted herein, or are implemented by this regulation. For automatic distribution of these handbooks contact the Director, USAATCA-ASO, Cameron Station, Alexandria, VA 22314, with proper justification. Subscription will normally be limited to commanders having responsibilities specified by AR 95-50 and air traffic and airspace (AT&A) officers.

WATCH FOR THE TERM "MOA". It will begin to appear on various aeronautical charts this month.

MOA is the result of a joint Federal Aviation Administration/Department of Defense (FAA/DOD) program aimed at minimizing the possibility of midair collisions between military on training flights, special flight maneuvers or exercise aircraft and nonparticipating military or civilian aircraft.

MOAs appearing on aeronautical charts will be identified by nicknames such as "Tarheel," "Moody 2," etc. The vertical and lateral limits of the area will be given along with times, altitudes and, in some cases, the type of military activity conducted.

MOAs will replace all air traffic control (ATC) Assigned Airspace Areas which are established outside the Positive Control Area. In addition all Intensive Student Jet Training Areas and Alert Areas will be reviewed and, where practicable, will be converted to MOAs.

An MOA does not impose any flight restrictions or communications requirements on nonparticipating VFR (visual flight rules) operations. VFR traffic may transit MOAs on their own responsibility. IFR (instrument flight rules) traffic will be cleared through an MOA only when IFR separation can be provided.

An extensive information program is planned by FAA to keep VFR pilots informed on the locations and activities of MOAs. NOTAMS (notice to airmen), inflight and preflight advisories will be widely disseminated until the process of publishing MOAs is completed.

THE METRIC SYSTEM IS ON THE WAY

ARE YOU PREPARED?

By 1980 the United States officially will be using the metric system along with the rest of the world. Are you ready? Could you buy meat by the gram or milk by the liter? If not, the solution is at hand.

Aviation Correspondence Subcourse 47. Introduction to the Metric System, is now available to help ease your way into the metric system.

For information on enrollment write:

Dept of Army-Wide Training Support
U.S. Army Aviation Center
P.O. Box J
Fort Rucker, Alabama 36362

MAINTENANCE REQUEST

For use of this form, see TM 38-750; the proponent agency is Office of the Deputy Chief of Staff for Logistics.

* See reverse of file copy for codes and additional data.

PAGE NO. | NO. OF PAGES | REPORTS CONTROL SYMBOL CSGLD-1647 (R1)

SECTION I ☐ WORK REQUEST ☐ MWO ☐ EIR ☐ ORGANIZATION ISSUE PRIORITY DESIGNATOR CODE

CONTROL NUMBER 284141 | 14. ORGANIZATION | c. UNIT IDEN CODE

2. SERIAL NUMBER | 3. NOUN NOMENCLATURE | 4. LINE NUM | 5. NATIONAL STOCK NUMBER

7. MAINTENANCE ACTIVITY | 8. UTILIZATION CODE* | 9. SELECTE ☐ 1 YES | 10. HOURS | 11. MILES | 12. ROUNDS | 13. STARTS

14. FAILURE (Select one - use X) | 15. FIRST IN | UBLE (Select one - use X or X): ☐ 056 OVERHEATING | ☐ 750 OUT OF ADJUSTMENT | ☐ 057 LOW | ☐ OTHER

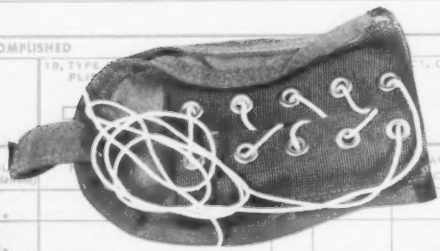
16. DES | LETE CHECKO | MENT. TM/ITI and preventive repairs

WORK ACCOMPLISHED

17a. REPAIR ORGANIZATI | UN | CODE | 18. TYPE PL | T. CODE

b. LOCATION

20 & 21. FAILURE CODE* | c. C | d. CH | e. MANHOUR | ARTS | ST



EIR

Did you know you can play a part in improving aviation life support equipment.
See page 44.

22. TOTAL PARTS COST

23. USE RECOVERABLE ☐ 1 PARTS | ☐ 2 MAN | FUNDS | DATA TRANSCRIBED TO LOG BOOK

24. SUBMITTED | ECTED BY | DISPOSITION (Select one - use X or X) ☐ C SALVAGED | ☐ 4 TO USER | ☐ D EVACUATED | ☐ 5 TO STOCK | ☐ E CANNIBALIZATION

JULIAN DATE | JULIAN DATE | DATE

SECTION III - EQUIPMENT IMPROVEMENT RECOMMENDATION

29. NORMAL REPLACEMENT (Applicable only if 'X' in 28) ☐ 1 YES ☐ 2 NO | 30. EQUIPMENT DOWN (Applicable only if 'X' in 28) ☐ 1 EMERGENCY ☐ 2 URGENT ☐ 3 ROUTINE | 31. RECOMMENDATION (Select one use X or X) ☐ A IMPROVE DESIGN ☐ C REVISE PROCEDURE ☐ B MODIFY ☐ D OTHER (Specify)

32a. ORGANIZATION/ACTIVITY | c. UNIT IDEN CODE

b. LOCATION | d. SUBMITTED BY

33. NATIONAL STOCK NUMBER | 34. NOUN NOMENCLATURE

35. OPINION OR REMARKS. DESCRIBE CONDITIONS UNDER WHICH FAILURE OCCURRED. ATTACH PHOTOS OR SKETCHES, IF AVAILABLE.

DA FORM 1 OCT 73 2407 EDITION OF 1 JAN 64 WILL BE USED UNTIL EXHAUSTED CONTROL COPY